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ABSTRACT

The study on reading comprehension presented in this report (the first of two) investigated whether expository passages with adjacent-to-text activities facilitate the learning of reading comprehension skills at the same time that they improve comprehension of text content, and whether written feedback increases the effectiveness of adjacent-to-text activities. Good, average, and poor readers in a combination fifth-sixth grade classroom were randomly assigned to participate in adjacent-to-text activities, adjacent-to-text activities with the use of an answer key, or reading only the text (control). Activities were designed to develop the Level E skills identified for the "Wisconsin Design for Reading Skill Development." This first report includes the rationale of the problem, along with a definition of terms and a summary of relevant literature, outlines the methods and procedures used in the study, discusses the results, offers a summary of six conclusions based on the results, (proving that adjacent to-text activities improve comprehension but not skills, while use of the answer key for feedback has a negative effect), and indicates the limitations and implications of the study. Twelve analysis tables and eight figures are included. (HAI)

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Technical Report No. 458
Part 1 of 2 Parts

THE EFFECTS OF ADJACENT-TO-TEXT ACTIVITIES ON THE DEVELOPMENT
OF READING COMPREHENSION SKILLS AND ON THE COMPREHENSION
OF TEXT CONTENT

by

Eve B. Wilkie

Report from the Project on
Studies in Reading, Language, and Communication

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THE EFFECTS OF ADJACENT-TO-TEXT ACTIVITIES ON THE DEVELOPMENT
OF READING COMPREHENSION SKILLS AND ON THE COMPREHENSION
OF TEXT CONTENT

Eve B. Wilkie

Under the Supervision of Professor Wayne Otto

ABSTRACT

The major purpose of this study was to determine whether a set of expository passages designed with adjacent-to-text activities (a type of adjunct aid) would facilitate the learning of reading comprehension skills concurrent with improving the comprehension of the text content. A second purpose was to determine whether written feedback would increase the effectiveness of adjacent-to-text activities. Other variables examined in testing the effectiveness of the technique were reading ability, prior knowledge, and skill application without the assistance of adjacent-to-text activities.

Good, average, and poor readers in a combination fifth-sixth grade classroom were randomly assigned to one of three groups. The treatment materials were designed by the investigator and include expository passages, adjacent-to-text activities, and answer keys to accompany the activities. The activities were designed to develop the Level E skills identified for the Wisconsin Design for Reading Skill Development: Comprehension (1977). Each activity was placed next to relevant text in a passage, indicated by a line marker in the text margin and a number corresponding to the number of the activity. Activities direct readers to read a short explanation of a specific skill, draw a picture

to enhance or demonstrate understanding of a skill applied in text, or questions. During the 14.5 hours spent in treatment sessions, one group (ACTIVITIES) used adjacent-to-text activities while reading the text, a second group (FEEDBACK) checked their responses to the adjacent-to-text activities with answer keys, and a third, or control group (READ) read the text but did not receive adjacent-to-text activities. Upon the completion of each of the four sections of the treatment materials the students were administered an experimenter designed multiple choice test of text content comprehension. A test of skill development was administered during the final three days. This test consisted of four selected tests of the Level E, Wisconsin Tests of Reading Skill Development: Comprehension (1977), forms P and Q.

Results of analysis of variance of students' correct responses on the test of skill development indicated that there was no significant difference between the average mean score of the two treatment groups (ACTIVITIES and FEEDBACK) and the mean score of the READ control group. From an analysis of covariance, there was a significant difference ($p < .0535$) between the average mean score of the two treatment groups and the control group on the measure of text content comprehension in the predicted direction favoring the treatment groups. There were no significant differences in the mean scores of the ACTIVITIES and FEEDBACK groups on either the measure of skill development or on the measure of text content comprehension. Mean percentages of correct responses on the measures of skill development indicated that the use of adjacent-to-text activities with or without feedback was no better

or worse for good or for poor readers. However, good readers who used adjacent-to-text activities without feedback were superior to good readers in the other two groups on the measure of text content comprehension. The text comprehension scores of readers with above and below the mean scores on a measure of prior knowledge who used adjacent-to-text activities were superior to those in the control group. There was no evidence of the application of skills to incidental text without the direction of adjacent-to-text activities.

The major conclusion from the study was that although there was no evidence of skill development, the significant result of the comparison of group means on the measure of text content comprehension suggests that the adjacent-to-text activities appear to function to direct readers' attention to relevant text inducing more active and thorough text processing. For this reason, research on the feasibility of the use of an adjunct aid format to improve readers' skills should continue.

Wayne Otto

RATIONALE

BACKGROUND TO THE PROBLEM

Various adjunct aids have been used to improve readers' comprehension and retention of prose materials. Specific adjunct aids have had a positive effect on readers' acquisition of information and concepts from the text for which the aids are provided. But few investigators have attempted to use adjunct aids to train specific reading skills to be used eventually without the assistance of the aids. The present research was conducted to determine whether a type of adjunct aid could be developed not only to improve readers' comprehension of written text but also to provide training in the use of selected comprehension skills.

Attempts have been made to improve readers' comprehension of text using various oral and written adjunct aids. Some adjunct aids provide additional or clarifying information to assist readers in understanding what they read and to improve their learning from text. Pictures, maps, charts, definitions, and background information are examples of adjunct aids which add to or clarify the text content. Other aids are intended to provide readers with a strategy to direct and shape their mental processes while reading text. Examples of adjunct aids used to affect readers' strategies are instructions to form mental images, instructions to use a self-questioning technique, written or oral advance

organizers and summaries, oral or written questions interspersed before or after text portions, and instructional objectives. Some variables examined in research on adjunct aids are knowledge of results, or feedback, and learner characteristics such as reading ability, and prior knowledge, or familiarity with the subject matter.

One limitation in the use of adjunct aids is that materials must be modified or created to incorporate the aids. Another is that often someone must be present to advise the reader to use a particular strategy. But a more basic problem exists. Readers may lack the prerequisite, or underlying reading skills necessary for the successful use of a particular aid. For example, a student may adopt a particular search strategy, or set to learn, from responding to questions placed intermittently after several paragraphs in text, but lack the reading skills necessary for successful employment of the strategy. The student may not be able to use basic skills like using context clues to interpret the meaning of unfamiliar words, using supporting details to determine main ideas, and using sequential markers to determine the order of events.

Although students commonly receive instruction designed to develop reading comprehension skills, the skills are often taught one at a time and in isolation from the act of reading an entire piece of prose. The skill instruction is often given through pre-reading and post-reading activities, including workbook and worksheet exercises and teacher directed lessons. Students appear to learn separate reading comprehension skills through isolated instruction. But the problem remains whether students put them together, so to speak, and select from

a repertoire of skills as needed when reading prose materials.

Intuitively, a solution to the problem would be to eliminate the teaching of skills in isolation. Perhaps reading comprehension skills could be introduced and taught in text as needed to improve readers' understanding of the content. As noted, various adjunct aids have been used to improve readers' comprehension and retention of text information. One way to provide skill instruction while reading would be to incorporate the instruction within a type of written adjunct aid. Perhaps students could learn skills while reading by receiving skill instruction and application exercises placed adjacent to text portions. For example, a reader may come across an unfamiliar word while reading. A note in the text margin might ask the reader to find a synonym clue in the vicinity of the unfamiliar word. The reader might then be asked to write his or her own definition of the word. The intent of the use of the adjunct aids would not be to induce the use of a more general strategy but to train readers in the use of skills as needed while reading. Once skills are learned, it is assumed that readers will consciously or unconsciously apply them when employing a more general reading strategy such as self-questioning, or when using adjunct aids which add to or clarify text content such as pictures.

Comprehension skill development materials were developed by the present investigator to teach skills in text with a type of adjunct aid called adjacent-to-text activities. Adjacent-to-text activities are intended to function like other adjunct aids to direct readers' attention to text portions of relevance to the aids. The use of the activities should improve readers' comprehension of text content because

specific portions of text are processed when the reader responds to the activities. Skill development should occur through reading and responding to the written instructions and application exercises of the adjacent-to-text activities.

A preliminary study was conducted by the present investigator to determine whether the use of the adjacent-to-text technique improved the comprehension skills and comprehension of text content of fifth grade readers. But a second, and perhaps more important purpose for the preliminary study was to determine whether the adjacent-to-text format for skill development could be used by students and whether teachers and students were receptive to the skills-in-text technique. The present study was based upon and was an extension of the preliminary study.

THE PROBLEM

The major purpose of this study was to determine whether a set of adjacent-to-text activities designed to accompany a supplementary reader served their intended function. That is, did the adjacent-to-text activities facilitate the learning of reading comprehension skills concurrent with facilitating comprehension of the text content? A second purpose was to determine whether written feedback (knowledge of results) would increase the effectiveness of adjacent-to-text activities.

In considering the effectiveness of the training technique, the following variables were also examined:

1. Reading ability. Do students classified as good or poor in reading ability benefit similarly from responding to adjacent-to-text activities while reading?
2. Prior knowledge. Do students with varying levels of prior knowledge of text-related concepts benefit equally from responding to adjacent-to-text activities while reading?
3. Skill application. Is there evidence to suggest that those using the training materials begin to apply the skills to text without the assistance of adjacent-to-text activities?

Following the definition of terms used in this study, a formal rationale for the specific hypotheses and questions is presented. The rationale is based upon empirical research evidence from a review of the literature and a preliminary study conducted by the present investigator. A review of the literature presents empirical evidence to support 1) training readers in the use of reading comprehension skills, 2) the use of an adjunct aid format as a vehicle for training in comprehension skills, and 3) the inclusion of selected variables in the design of the study. The results of the preliminary study conducted in classroom settings constitutes evidence of the acceptance and usability of the adjacent-to-text materials by teachers and students.

DEFINITION OF TERMS

Adjacent-to-text activities are written activities designed to teach skills of reading comprehension where their application is appropriate to improve both the learning of particular skills and the text content. An example of a page of text with adjacent activities is shown in Figure 1. Because they are placed next to relevant text content, the activities function as orienting stimuli to activate and direct attention in a manner similar to other adjunct aids such as advance or cognitive organizers, interspersed questions, or instructional objectives. The activities are designed to be self-paced and self-directed. The student reads the prose until he or she comes to a line-marker on the right margin of the page. The number next to the line-marker directs the reader's attention to the adjacent activity matching that number. The activity instructs the reader to apply a comprehension skill and directs attention to the relevant text content within the marker.

Reading comprehension skills are among the skills identified for the Wisconsin Design for Reading Skill Development (Design), (Otto and Kamm, 1977). The skills and objectives within each meaning unit have been arranged in a developmental sequence corresponding to seven grade levels from kindergarten through grade six. The meaning units of concern are word meaning, sentence meaning, passage meaning, and sequence. The skills of importance to this study corresponding to each meaning

A Grassland Ecosystem

Now picture yourself on a western prairie as the sun rises on the green grass. A prairie is a grassland environment, and there are few trees. Trees do not grow into forests on the prairie for several reasons. First, there is usually not enough rain. Another reason is that the soil made by the thick root system of the grasses crowds out new growth. The grazing of animals helps, too, because the trees are eaten when they are very little. Finally, frequent fires have played a big part in preventing the growth of trees. The prairie has four seasons like the forest, but the seasons are drier than in a forest. For this reason, different kinds of plants and animals live on the prairie.

At sunrise on the open grassland, some animals are beginning their day. Others are turning in after a busy night. Bending their large heads, a herd of bison, the American buffalo, eat grass for breakfast. Their teeth have large grinding surfaces, which make chewing the grass easy. The bison are designed, or made, to live on the grassland. They are adapted to the ecosystem.

Some distance away, a herd of pronghorns, deerlike animals, is feeding. Their leader suddenly stops and stares across the wide prairie. Seeing a moving form in the grass, the pronghorn turns and speeds away. Instantly, the herd follows, disappearing quickly into the far distance.

A Grassland Ecosystem

43. The information in passage 43 tells about the topic: there are few trees on a prairie. Find the sentence that states this topic. Write it on the line.

44. The sun rises in the morning. Some animals become active at this time. Some animals "turn in" or start to rest in the morning. What can you say about animals being busy during the day or at night?

Some animals are busy _____.

Some animals are busy _____.

What is a buffalo busy?

45. A very short context clue tells you something about pronghorns. They are like another animal. This animal is a _____. You must know what _____ are like to know what pronghorns are like. Draw what a pronghorn might look like.

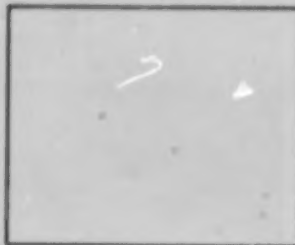


Figure 1. Sample text with adjacent-to-text activities

unit are as follows:

1. word meaning a.) The reader identifies word parts -- prefixes; b.) The reader identifies explicit context clues -- application.
2. sentence meaning a.) The reader notes detail in sentences with more than one subordinate clause; b.) The reader paraphrases complex sentences.
3. passage meaning a.) The reader identifies central thought with organizer (topic sentence); b.) The reader identifies conclusions from direct relationships.
4. sequence -- The reader determines sequence from explicit cues.

Comprehension of text content is defined as both intentional and incidental text comprehension. Intentional comprehension involves the recognition of text content that will have had a particular skill applied via an adjacent-to-text activity. Incidental comprehension involves recognition of text content in the same textual vicinity where the same skill could be applied, but had not been directly applied via an adjacent-to-text activity.

RELATED LITERATURE

The review of literature is organized in three parts. First, support for the need to train readers' comprehension skills as a prerequisite to the successful employment of a reading strategy is presented. Second, the basis for using adjunct aids as a vehicle for training readers' comprehension skills is presented. Third, research

related to the selected variables included in this study --- feedback, or knowledge of results, reading ability, and prior knowledge -- is reviewed.

Need for Training Comprehension Skills

Comprehension may be defined as a change in understanding through the reorganization of existing knowledge or the addition of new information. But comprehension ability may not automatically accompany decoding (word identification) ability. Effort on the part of the reader is required to organize the meaning of words into larger meaning units, i.e., sentences and passages, which permits higher levels of comprehension to occur. Laberge and Samuels (1974) put it this way:

If a subject maintains attention solely on single-meaning codes (one word), this would constitute a rather low form of comprehension, much like viewing characters in a play one-by-one and ignoring their interactions. On the other hand, for high-level comprehension of passages, attention must be directed to organizing these meaning codes, and presumably this is where effort enters into reading (p. 320).

That decoding skills may be necessary but not sufficient for successful comprehension of prose was demonstrated in a study of Okan, Wiener, and Cromer (1971). Fifth graders who were poor in reading comprehension showed no improvement in comprehension despite being trained to identify all the words in the stories which they were subsequently asked to read. The comprehension of good readers was not significantly affected by poorly organized material (a printed version of an oral reading distorted by omissions, errors, and substitutions) whereas the comprehension of poor readers declined. It appears that good

readers impose order on the input of written materials but that poor readers lack organizational strategies.

But it is not only poor readers who may be unable to organize words into larger meaning units. Smith and Hesse (1969) feel that both good and poor readers have comprehension difficulties as demonstrated by their inability to recall details or main ideas and to make inferences from a selection which they have read. They suggest that such failures in comprehending indicate a lack of an organizational strategy. But the reason for failures to recall details or main ideas and to make inferences may be because these readers did not learn the skills in the first place. Perhaps instruction in the more basic comprehension skills should precede attempts to provide readers with organizational strategies.

Whether students need specific instruction in order to learn comprehension skills is not known. Bormuth (1969) defines comprehension ability as a "set of generalized knowledge-acquisition skills which permit people to acquire and exhibit information gained as a consequence of reading printed language" (p. 50). Bormuth presents the position that children must be taught processes necessary to acquire information from language and they must also be taught the skills necessary to exhibit that information. Spache and Spache (1973) take a similar position regarding the teaching of comprehension skills. They argue that: "--few of the behaviors we expect to see in comprehension or critical reading, except perhaps vague main ideas and retention of scattered details, appear spontaneously among pupils" (p. 560). The present investigator assumes that instruction in the use of reading

comprehension skills will assist readers in developing a set of skills to use when applying any reading or study strategy.

Adjunct Aids to Train Readers' Comprehension Skills

The research reviewed here shows that various adjunct aids have been used directly or indirectly to provide students with a reading or studying strategy. The provision of some adjunct aids has improved readers' comprehension or retention of text. Although the strategies associated with particular aids may vary, adjunct aids share a common property. That is, the adjunct aids function to direct readers' attention to certain aspects of text. Because adjunct aids serve to direct readers' attention, the idea was conceived that adjunct aids could be used to train readers' comprehension skills.

Manipulating comprehension strategies with adjunct aids. Two broad approaches to using adjunct aids to manipulate students' reading comprehension strategies have been used by researchers. The first involves attempts to directly induce a reading strategy within the reader. The second technique has been to alter or add to the reading materials to indirectly induce a comprehension strategy. Imagery instructions, advance or cognitive organizers, verbal instructions, and study directions have been used to directly induce a reading strategy. Study aids have been implanted in text, text has been organized into phase units, words have been omitted or added, and questions have been interspersed throughout the text to indirectly induce a reading strategy.

Direct approaches via the learner. One approach to induce a comprehension strategy is through instructions to produce visual images of

materials being read. The assumption is that learning situations are not optimally structured, that the learner must process materials with active mental transformations. That is, the learner must be equipped with organizational strategies (Levin, 1974).

Anderson and Kulhavy (1972) told a group of high school seniors to form mental images while reading a 200 word textbook-like passage. On a short-answer and multiple-choice test, the experimental group scores were not significantly superior to those of a control group. But results on a questionnaire indicated that more than half of the control group reported using imagery while about one-third of the experimental group reported not using imagery. After reanalyzing the data, the investigators concluded that persons learn more from a prose passage if they form images of things and events.

Using regression analysis to predict a person's reading comprehension score and reading attitude on the basis of vividness of self-reported mental imagery, Cramer (1975) concluded that for eleventh and twelfth graders, there was no relationship between self-reported imagery vividness on the Sheehan Questionnaire and reading comprehension scores on the Davis Reading Test. There was a significant relationship between attitude on the Estes Reading Scale and imagery. Apparently, subjects with the most positive reading attitudes had the most vivid images. Because this was not an experimental study, the results offer no clarification of whether readers' comprehension can be improved by inducing an imaging strategy.

Visual imagery as an organizational strategy to enhance written

prose comprehension was not supported from the results of two experiments by Levin and Divine-Hawkins (1974). In one experiment, good and average fourth grade readers were presented either a written or oral version of two, ten sentence passages. Half of each group received imagery instructions. Those receiving instructions to image received significantly more correct responses on 10 questions of content comprehension. But a significant interaction effect indicated that the effects are much greater in the listening than in the reading condition. The investigators felt that reading and imaging may conflict as both are visual systems.

There is some evidence that students who are "difference" poor readers according to the Wiener and Cromer (1967) classification -- readers with good vocabulary skills but poor comprehension -- may benefit from imagery instructions (Levin, 1973). Such readers with instructions to image scored 26 percent more correct responses than "difference" readers without imaging instructions.

On the basis of these studies, one cannot state that imaging will provide an organizational strategy to enhance written prose comprehension which can be induced with instruction; but one can say that good comprehenders and students who like to read often report using visual images while reading and that some readers may benefit from instructions to form visual images.

Another approach to manipulating readers' cognitive structures in order to facilitate the incorporation of new information with existing conceptual knowledge is to provide the learner with a written or oral

advance or "cognitive" organizer. According to Ausubel (1966, pp. 103-115) one's cognitive structures of concepts are hierarchically organized from most general and inclusive to specific data. As new information enters the cognitive field, it interacts with and is subsumed under a relevant and more inclusive conceptual system. An advance organizer (written passage) can be presented to provide an overview of the information to follow as an ideational scaffold and to present information which discriminates new ideas and information from that previously learned.

Ausubel (1960) tested the effect of a written introductory passage (advance organizer) on college student's recognition of information contained in a 2500 word passage on properties of carbon steel (unfamiliar content). The organizer group mean recognition scores were significantly higher than those of the historical introduction control group. Similarly, Ausubel and Fitzgerald (1961) found that an organizer comparing Buddhism and Christianity facilitated comprehension of a passage on Buddhism but primarily for students who scored below the median on a pretest of Christianity. Some similar positive findings have been reported, but many investigators have found no effect associated with advance organizers. In a review, Barnes and Clawson (1975) concluded that of thirty-two studies, only twelve reported facilitative effects.

Like imagery instructions, an advance organizer may facilitate the comprehension of poor readers more than good readers. Smith and Hesse (1969) presented eleventh graders with an oral organizer before a biographical passage. Results indicated that the organizer had a negative effect on the comprehension (seven item posttest) of good

readers but a positive effect on poor readers' comprehension.

Andrews (1971) used the same materials but added a directed reading question, (DRQ) group and an organizer plus DRQ group. All treatments were orally presented before silent reading. He found that the seventh grade organizer group scored significantly higher than the DRQ group. This is not surprising as the organizer was much longer and therefore more instructive than the DRQ treatment.

A general statement on the effectiveness of advance organizers is not possible. Some research results have been favorable while others have been neutral or even negative. Differences in the type and length of organizer, mode of presentation, characteristics of the learners, and familiarity or practice in the use of organizers used in the investigations may explain the confusion as to the effectiveness of the use of advance organizers.

Before there was an interest in organizers, another approach was used to manipulate readers' strategies. Stordahl and Christensen (1956) provided Air Force employees with instructions to use one of the following study techniques while reading: 1) underlining, 2) outlining, 3) summarizing, and 4) reading only. None of the instructions had an effect on comprehension test scores.

What these attempts to directly manipulate reading strategies appear to have in common may be what is described by Postman and Senders (1946) as experimentally inducing a set to learn, which is a state of preparedness, a readiness to respond selectively to a circumscribed range of stimulus materials. The writers guessed that an explicit set

to learn may invoke a generalized set to learn within the reader. In an experiment, the writers attempted to induce various specific sets to learn in order to test the generality of set hypothesis. The generality of a set is the degree of incidental, or non-experimentally directed learning which occurs. To induce the various explicit sets to learn, different pre-reading directions were given to five groups of college subjects. Before they read Chekov's The Bet, subjects were told they would be tested on 1) general comprehension, 2) specific sequence of events, 3) details of content, 4) details of wording, or 5) details of physical appearance. Results on a 50 item test, 10 from each category, supported the notion that a generalized set may be induced by an implicit set to learn; but those provided with the explicit set to read for general comprehension did not show an increase in general comprehension. Instructions to read for details of content, details of wording, or details of physical appearance improved general comprehension.

Indirect approaches via materials. Attempts have been made to improve readers' comprehension of text by altering the materials to fit characteristics of the learner or to induce processing strategies. An assumption in the Wiener and Cromer (1967) study discussed earlier is that "difference poor" (word-by-word) readers lack organizational strategies. One solution would be to provide training to provide the "difference poor" reader with organizational strategies. Another solution would be to provide the difference poor reader with reading materials more appropriate to their "mode of responding." In a study, Cromer (1970) used the Wiener and Cromer (1967) system to classify

college students as good readers, deficit poor readers (low vocabulary and low comprehension scores) and difference poor readers (low comprehension but high vocabulary scores). Stories from the Davis Reading Test, Series 1 were presented in four modes of grouping words and sentences: 1) regular sentences, 2) meaningful phrases, 3) single words, and 4) fragmented word groupings. The difference poor readers answered more questions correctly on the phrase mode than on the other three modes. On the phrase mode, the difference group did as well as the good readers group on comprehension scores. Deficit poor readers performed best on the single word mode and good readers matched with difference poor readers performed best on the regular sentence mode. Apparently one could develop different sets of materials to match different reader characteristics but the process would be costly and perhaps complicated by further discoveries of learner categories and facilitative techniques.

Another view of assisting the word-by-word reader (poor comprehender) is that comprehension will be improved by forcing the reader to actively attend to the materials by answering questions or completing blanks. Anderson, Goldberg, and Hidde (1971) omitted the final word on each of 24 sentences. The blank group outperformed the whole sentence group in mean percent recall of the missing word of the sentences after receiving the subject noun of each sentence as a cue. Also, the blank group was significantly superior to the control group on a test where the last word of each sentence was the cue and the

response tested was the subject noun.

Another technique to arouse general attention for more meaningful text processing has been to add a word to every fifth word of text (Carver, 1974). While utilizing such programmed prose, the reader marks which of the two words belongs in the sentence. Carver guessed that because of the forced general attention aspect of the programmed prose, it would result in more general learning than adjunct questions which force attention upon specific aspects of text. Results of three experiments with high school males and three treatments using a Navy training manual (regular prose, adjunct questions, programmed prose) support this position. Carver concluded that programmed prose is more effective than regular prose in terms of general learning effect but as it takes more time, is less efficient than regular prose.

In an earlier study, Christensen and Stordahl (1955) attempted to improve reading comprehension by altering the materials rather than through instructing the subjects. Again, Air Force personnel read passages from extension course materials. Thirty-six versions of the passages were created from various combinations of the following textual additions: 1) outline at the beginning, 2) summary at the beginning, 3) summary at the end, 4) underlining main points, 5) headings in statement form, and 6) headings in question form. Results on immediate and delayed testing of retention after treatment were nonsignificant.

While the research reviewed, imagery instructions, advance organizers, study directions, phrase groupings in text, word deletions or additions, and text outlines, is based upon divergent theoretical posi-

tions on the nature of comprehension or learning from text and how it might be improved, there is a common thread to the techniques used by these investigators. As adjunct aids, these techniques serve as orienters: external to subject variables which affect prose learning (Kumar, 1975). Orienters serve as signal stimuli to alter the signal value of the passage. They initiate attentional processes in the reader to receive what happens next.

Two attentional processes are involved during the processing of text. The first type of attention is called overt or observable attention by Laberge and Samuels (1974) and is defined by Anderson (1970) as the type of attention which is the orientation of the receptors towards the stimulus. In terms of reading behaviors, this means that the reader looks at the words. Selective attention is a covert mediational process. Anderson describes covert attention as an encoding response to the stimulus. The reader covertly "selects," so to speak, the effective stimuli, e.g., words comprehended, from the nominal stimuli, e.g., set of words presented. Orienters, or signal stimuli in the form of techniques to manipulate comprehension strategies, e.g., adjunct aids, induce "selective attentional processes," or a "set to learn." Kumar (1975) identifies the kinds of orienters as: 1) stimuli with pointing or instructing properties, i.e., instructions to learn, adjunct questions, 2) advance organizers, captions, underlining, or words such as "note," and 3) out-of-context stimuli.

The literature reviewed supports the notion that adjunct aids may serve as a vehicle for facilitating readers' use of comprehension strategies because they serve as orienters to initiate and direct the

readers' attentional processes.

A final method involving the structuring of materials to manipulate attention as a vehicle for improving comprehension is the use of interspersed or adjunct questions in text. The adjacent-to-text activities designed by this investigator to teach reading comprehension skills in text resemble interspersed questions. They should serve as orienters to arouse and direct selective attention to confer signal value upon text information, i.e., determine the effective stimuli, and have a direct instructive effect on text comprehension.

Recognizing that subjects' activities while reading are important and perhaps more important than factors associated with the difficulty of text, Boker (1974), Frase (1967, 1968), Rothkopf, (1966) and Rothkopf and Bisbicos (1967), reported evidence that questions placed before or after text segments facilitate the retention of question-relevant content. All confirmed that the post-questions also had a facilitative effect on the retention of non-question relevant content (incidental retention).

Two of the few experimenters to investigate the effect of interspersed questions on the prose learning of school children reported a similar superiority of treatment groups over a control group on total recall. The experimenters (Swenson and Kulhavy, 1974) also reported that the fifth and sixth graders receiving questions after text segments had superior scores as compared to students with pre-questions on intentional test items. The post-question treatment group did not exhibit an increase in incidental learning. The investigators con-

cluded that unlike adults, children may disregard incidental material when specific cues are available. Perhaps questions function as pre-questions for children regardless of placement; and as Frase, (1968, 1970) suggests, they serve as orienting stimuli which influence learners' inspection of text. Selective attention directs organizational strategies towards relevant text segments to the detriment of incidental learning. Post-questions, on the other hand, may function as summary or review statements rather than as orienting stimuli.

The adjacent-to-text activities designed for the present study are placed next to, rather than before or after, relevant text; but they are intended to have the effect of pre-questions or instructional objectives in activating and directing attention. The purpose for the activities is to train subjects in using reading comprehension skills via an attention directing format. The activities are not intended to produce a forward processing effect, or test-taking orientation within the learner, which is the mathemagenic behavior thought to be induced with interspersed post-questions. The mathemagenic behavior shaped by post-questions is a temporary study behavior to enhance retention of the material at hand. (See Rothkopf, 1971, pp. 284-306 for a discussion of mathemagenic behaviors, those activities which "give birth to learning"). The assumption is that with instruction and practice in using comprehension skills in text, readers will begin to apply skills independently in response to salient text cues.

While pre-questions and instructional objectives apparently direct readers' attention and induce a set to learn, there is some evidence of

a more general learning effect. Years ago Washburne (1929) wondered whether questions should be placed before, after, or throughout text and whether questions attract attention to one set of facts at the expense of others. He gave junior high students one of five forms of a history text passage; 1) no questions, 2) questions at the beginning of text, 3) questions at the beginning of paragraphs, 4) questions at the end of paragraphs, and 5) questions at the end of the story. Results on a posttest of non-experimental questions and experimental questions in a factual or generalized form indicated that questions at the beginning results in a "mind set or generalizing tendency." The preview and interspersed preview questions' effects were superior. When all questions precede, recall of specific facts is aided and recall of other facts is not interfered with. Interspersed questions rather than preview questions interfered with the recall of facts other than those connected with questions (incidental facts).

Investigating the role of objectives, Kaplan and Rothkopf (1974) found that providing readers with instructional objectives increased both the amount of objective relevant material learned and the amount of incidental, or objective irrelevant material learned.

There is further support for both the selective attention effect and a more general learning effect of instructional objectives. Kaplan (1974) investigated the effect of presenting all objectives prior to text (whole) or distributed among text segments (part). The presentation of objectives facilitated intentional learning with either increases or no loss in incidental learning. But the part presentation resulted in greater intentional learning than the whole condition.

Kaplan and Simmons (1974) found objectives to be facilitative whether placed before or after the text. But performance on recognition of incidental material was greater when objectives were located after the text.

Results consistently support the conclusion that the use of instructional objectives improves the learning of text content relating to the objectives but the effect of objectives on incidental content is unclear. Contrary to the Kaplan (1974) and Rothkopf (1974) studies, Duchastel and Brown (1974) found that incidental material was recalled less well than objective relevant material by college subjects enrolled in an objective based mastery course. Likewise, Rothkopf and Billington (1975) report that college students receiving learning goals did not perform as well as a control group on incidental test items. Placing objectives throughout or at the end of the text apparently lessens the tendency for students receiving instructional objectives to learn only the objective relevant content.

It appears that the criticism by Carver (1974) that study questions (or objectives) usually have not been designed to represent the entire domain of important information is valid. Thus the danger in using the adjunct question technique is that important information will not be learned because attention has been focused upon the study questions (p. 18). There appear to be two solutions to this problem, both of which the present study addressed. One was to design questions which induce a more thorough processing of text. Another was to train the reader to apply reading skills without the assistance of adjunct questions.

Several investigators have attempted to design adjunct questions to induce more thorough text processing. Watts and Anderson (1971) interspersed text with questions which either 1) repeated examples of principles from text, or 2) required application of a principle to new examples. High school subjects who received the application treatment performed significantly better on posttest questions of both types (repeated example and application) than the other groups. The investigators concluded that more thorough text processing contributed to the superior scores of the application treatment group.

In a similar study, Rickards and DiVesta (1974) examined the effect of question frequency and meaningful versus rote learning questions on total recall. Subjects receiving meaningful learning adjunct questions and rote-learning of ideas questions performed significantly better than subjects receiving rote-learning of facts or task irrelevant questions. For frequent questions (after every two paragraphs), only meaningful learning questions produced a significant increase in total recall.

More thorough text processing also occurred when subjects received topical directions rather than directions repeating exact words used in text. Frase and Kreitsberg (1975) report that on a test of factual recall of intentional and incidental items, recall of relevant information was only slightly higher for word directions, ($\bar{X}=58\%$) than for topical directions ($\bar{X}=54\%$). But recall of incidental items was significantly lower for word directions ($\bar{X}=29\%$) than for topical directions ($\bar{X}=46\%$). Although more thorough text processing will result from using higher order, non-factual recall-type questions, e.g., application or "meaningful learning" questions, one problem is that the behaviors are

only temporary. Moreover, some readers might not be able to benefit from the questions if they lack more basic comprehension skills like those of concern in the present study.

Training comprehension skills with adjunct aids. While it has been established that various techniques are effective in improving readers' comprehension strategies, it appears that training specific comprehension skills is a more complex task. The two aspects involved would be first to determine the skills one wishes to train and second, to devise a training technique. Comprehension is a form of thinking and because opinions vary as to the nature of thinking and the product or products of thought, it is not surprising that the nature of comprehending and the product or products of comprehension are controversial. The skills one selects to train will vary according to one's definition of comprehension. In addition, the nature of training varies according to criterion measures of success, expectation of short-term or long-term results, and amount of time and effort involved. The major conclusion to be drawn from the research that follows is that there is an acknowledged need for training in the use of reading comprehension skills. Attempts have been made to provide training in skills considered to be necessary for the successful use of a reading strategy. Also, training has been provided in the use of skills associated with specific adjunct aids.

Lesgold, et al. (1975) devised a four week training program to determine whether imagery skills could be taught to third and fourth graders and thereby facilitate the use of an imaging strategy while read-

ing. On the first day, students drew stick figure cartoons illustrating the sequential events and main ideas in stories. On the second day, cartoon prompts were used to recall story facts. On the third day, students showed something of relevance to each sentence in a story from their cartoon drawings. These types of procedures were used throughout the training period. A control group read and answered multiple-choice questions. After reading stories, subjects' mean scores were 42 percent higher for the cartoon group (imagery training) on a paraphrase recall test of the stories. The writers noted that to get the effect of training a prompt in the form of direct imagery instruction is needed at the time of reading.

Interpreting Leagold's training in cartoon drawing as largely irrelevant to the construction of "internal mediators," Pressley (1976) gave eight year old children only a few minutes training in making up internal images on successively longer prose passages. Training consisted of the following sequences: 1) an oral sentence -- directions to "make up a picture in your head," -- and a slide picture of what the sentence might look like, 2) a similar sequence with two paragraphs, and 3) a training story booklet sequence with a blank page next to each text page to allow imaging when looking at that page. All students read a test story booklet. The experimental group was told to construct mental pictures on the blank pages. The students receiving the imagery training significantly outperformed the control group on a measure of reading comprehension. Pressley concluded that imagery training to improve reading comprehension can be given in a classroom situation.

But the question remains whether even with training students would use an imaging strategy without prompting or blank spaces in text.

Spiegel (1976) predicted that training in the "habits" or "skills" used when reading materials with two adjunct aids, i.e., advance organizers and post-questions, would lead to a transfer of the skills to materials without the adjunct aids. She argued that training in the use of aids is important but is of limited usefulness because few materials incorporate such aids; therefore, students should receive training in using the reading strategies learned during work with adjunct aids when reading materials without adjunct aids. Good, average, and poor eighth grade readers were given training in using advance organizers or interspersed post-questions and then trained to use the "habits" developed in using either of these aids. The habits assumed to develop from the use of advance organizers were to use the title and the first sentence of every paragraph to construct an overview of the materials to be read. The habits assumed to develop from the use of interspersed questions were to stop, reflect and formulate questions to use as a guide while reading. Essentially, one group was first taught how to use an advance organizer and then was taught how to construct an overview as a pre-reading activity. The second group was taught how to use interspersed questions and then was taught how to stop and formulate their own questions to direct their reading. There was one significant result from the experiment. Good readers in the interspersed questions group received significantly higher scores on a measure of the literal comprehension of the modified materials as compared to good readers in the

advance organizer group and comparison group.

While it may be beneficial to students to learn how a particular aid should improve their reading comprehension and perhaps even more beneficial for them to learn how to preview a selection and/or formulate questions while reading, training in the use of aids does not necessarily lead to training in the use of particular reading strategies or skills. The purpose of an organizer is to provide additional material to text on a higher level of abstraction and generality than that contained in text. An advance organizer is a form of assistance in reading. One would not expect a reader to generate his or her own advance organizer. The advance organizer will, of course, induce certain inspection behaviors, or a cognitive mind set, so to speak. Also, the reading behaviors shaped while answering questions in text are intended to improve the comprehension of only the modified materials. According to Rothkopf (1972a, p. 327), when adjunct questions are omitted, mathemagenic behaviors (inspection behaviors resembling attention) associated with interspersed questions become less effective and in fact tend to disintegrate without outside support.

What Spiegel was investigating was whether responding to adjunct aids provided skill practice and whether the skills which she believed were associated with two particular aids could be trained. But in a study to determine whether answering certain types of questions provided problem solving skill practice, Mayer (1975) concluded that interspersed questions influence learning by acting as cues concerning goals of instruction. Interspersed questions do not have a backward effect of

review or rehearsal or provide question-answering skill practice. Employing a method used by McConkie, et al., (1973) Mayer gave subjects a series of set-inducing passages, each containing a certain type of question. Some answered questions after passages and others simply read them as instructional objectives. Because there was no difference between the target passage test performance of subjects who actually answered questions and those who merely read them, the forward, or set inducing hypothesis was supported. There was no evidence that actually solving problems (questions group) had a different effect on reading strategies employed on a transfer passage than simply reading a list of the same questions before reading the text passage. These findings lend support to the notion that attention is a selective process induced by adjunct questions that reduces the number of irrelevant hypotheses as to the goals of instruction.

The assumption underlying the present study is that adjacent-to-text activities function as other adjunct aids in inducing selective attention to relevant text portions. The effect of training in the use of reading skills was expected to occur through direct written instruction within the adjunct activities in the use of the various comprehension skills and through practice in applying skills to text.

Recognition of the need to supply readers with reading skills, such as summarizing or outlining skills, was suggested by Stordahl and Christensen (1956). The writers believed that if Air Force personnel had received training in outlining, underlining, and summarizing, the directions to do so while reading might have had some effect on the

subjects reading behaviors.

An example of providing training in prerequisite skills needed for the employment of a reading, or study strategy is the work of a group of Soviet psychologists to train mediated memory techniques in young children. In experiments conducted by Mal'tseva (1971-72), children were instructed in extracting main ideas, compiling a textual outline and then using the outline for mnemonic purposes. After training in these three stages, second, fourth and sixth graders were able to compose an outline but only the fourth and sixth graders were able to generate an outline automatically as a mnemonic device. All required help to develop the ability to analyze headings of ideational parts of text and to employ conceptual classification. Instruction in conceptual classification began with extracting main ideas through a technique of textual analysis with wh-questions (which, where, when, who, what) and questions on logical subject and predicate of each ideational part of text. The subjects asked and answered questions aloud. They gradually moved towards independence in ability to analyze text and eventually could use these skills as mnemonic activities.

The present investigation is related to these attempts to provide training in prerequisite skills needed to successfully use a strategy independently; but the adjunct aid format was not intended as a technique to develop a particular reading strategy to provide practice in applying the skills associated with the employment of a particular adjunct aid. Instead, the intent was to capitalize upon the attention directing properties of adjunct aids by focusing readers' attention on

particular text segments by activating selective attentional processes as a condition of responding to the adjacent-to-text activities. Comprehension skill development was expected to occur as a result of direct and indirect instruction in the use of skills and application through reading and writing responses to adjacent-to-text activities.

Adjunct Aids and Feedback, Reading Ability, and Prior Knowledge

Feedback and adjunct aids. In several studies on adjunct questions, students have been provided with feedback, or knowledge of results in the form of the correct answers to the questions. According to Ausubel, (1968, p. 315), one would expect that knowledge of results would be an important variable. But due to gaps and inadequacies in the research, there is little unequivocal information as to its actual effect on learning. In behaviorist theory, feedback serves largely as reinforcement. In terms of cognitive effects, knowledge of results appears to consolidate the student's learning and enhances the ability of the student to selectively focus attention on those aspects of the task requiring further "refinement." Ausubel concludes that feedback is not indispensable for learning; but on both motivational-reinforcement grounds and cognitive grounds, it should facilitate learning.

Most of the studies on the effects of feedback on learning have been conducted with programmed materials and are not directly relevant to the present investigation. There has been some research on the effect of providing feedback, or answers to adjunct questions. Results of the studies are similar to those of the two major studies on feedback and adjunct questions.

Frase (1967) investigated the effect of supplying knowledge of results to pre and post-questions in text read by college students. Two, multiple-choice factual questions were interspersed before or after two paragraph text segments. The knowledge of results treatment consisted of repeating the number and correct response along with the stem of each adjunct question. There was a significant effect of knowledge of results on posttest retention questions for both questions before and questions after conditions. Frase reported that when knowledge of results were provided, the position of the questions did not make much difference. When knowledge of results were not provided, the questions placed after text segments were more effective on performance.

Similar results were reported by Rothkopf (1966). Subjects were assigned to a control group or to one of five experimental treatments: 1) questions and answers before each section, 2) questions without answers before each section, 3) all questions and answers before the entire passage, 4) questions after each section with answers, and 5) questions after each section without answers. The experimental subjects wrote the answers to the questions before they were shown the correct answers. Treatment groups receiving answers after responding to questions were significantly superior to those not receiving answers on the measure of intentional, or question relevant learning. Rothkopf (1972a, p. 326) concludes that providing subjects with knowledge of results, or answers to adjunct questions does not have much effect on mathemagenic (inspection) behaviors but does have a direct instructive effect, i.e., increased retention.

On the basis of studies like these, feedback should serve to reinforce and consolidate learning and perhaps to enhance attentional behaviors. The present investigator assumed that providing feedback on correct or acceptable written responses to adjacent-to-text activities would enhance the effect of responding to activities on text comprehension and skill development.

Reading ability and adjunct aids. In addition to feedback, individual difference variables should be considered in designing instructional materials. According to Glaser (1971, p. 349), the interaction between entering behavior and instructional variables is often ignored. To account for an interaction, aptitudes or prior learnings are measured prior to instruction.

Investigators of "aptitude by treatment interactions" have provided evidence to support the assumption that students with varying ability levels may react differently to certain instructional treatments. Skanes, et al. (1974) compared the effects of two methods of problem solving (direct practice or indirect practice) on students varying in intelligence from grades five through nine. Half of the students received a pretest. Results indicated that students with Otis I.Q.'s above 100 did significantly better with a pretest than without and that the reverse was true for those with I.Q.'s below 84. Students with Raven I.Q.'s less than 104 received higher posttest scores with direct practice, whereas for those above 133, indirect practice was superior. A pretest may function as instructional objectives for high ability students while a pretest may confuse or discourage the less able

students. But most students would be expected to benefit from direct practice in solving problems, because the population of students who did not benefit from such practice (I.Q. above 133) must be quite small.

Researchers indicate that in addition to a pretest, adjunct questions may have different effects upon learners with different characteristics. Koran and Koran (1975) administered aptitude tests of verbal comprehension (vocabulary) and associative (short-term) memory abilities to university students. Then the students read prose passages. One group received post-questions after each page. Another group received post-questions after four pages. A control group did not receive questions. The prediction was that students higher in verbal ability would benefit from infrequent questions while those with less verbal ability but greater associative memory abilities (short-term memory abilities) would benefit more from responding to more frequent questions. Results supported this expectation. Associative memory scores were positively related to performance by the control group. Scores on the vocabulary test (verbal comprehension ability) were positively related to performance in the control treatment and in the infrequently questioned group but were unrelated to performance in the frequently questioned group. The writers concluded that associative memory functions in a manner opposite to verbal comprehension (an aspect of general intelligence). Frequent adjunct questions may require less of analysis and comprehension and should benefit the less verbally able students, or those with greater associational memory abilities.

Further evidence that adjunct questions may aid students with

poorer memory abilities and may even interfere with the learning of highly verbal subjects was reported by Shavelson, et al. (1974). The investigators noted that Berliner (1971) found that subjects with low scores in memory ability benefited from inserted questions whereas the learning of subjects with high memory ability may have been disrupted. To determine whether the learning of junior college subjects with varying aptitudes is affected by certain treatment variables, higher-order or lower-order questions were placed either before or after text segments. The insertion of the higher-order questions appeared to aid subjects with low verbal comprehension, or low scores on a vocabulary subtest of a standardized achievement test. The higher-order questions may function to promote review in subjects who ordinarily do not engage in such activities. The negative regression slope indicated that higher-order treatment interfered with the prose learning of subjects high in verbal comprehension. On the basis of these results, Shavelson et al. concluded that students low in verbal comprehension might be assigned to text with higher-order postquestions, whereas high ability students might be given text without questions.

The results of research on techniques to improve reading comprehension of text support the probability that different instructional methods or materials may have a differential effect for readers with varying abilities. For example, difference poor readers (good vocabulary skills but poor comprehension) benefited from phrase groupings in text and with imaging instructions. Likewise, an oral advance organizer benefited those who were poor readers and a written advance organizer

primarily benefited those with relatively low verbal ability.

Not all research results have supported the assumption that adjunct aids or some form of induced mediational processing is more beneficial for low aptitude students than for high aptitude students. Spiegel (1976) found that good readers in the interspersed questions group had superior scores for literal comprehension of text over good readers in the advance organizer and comparison groups. Training in the habits used with an advance organizer and interspersed questions did not improve the reading comprehension of average or poor readers. Likewise, Sanders (1973) found that high ability subjects who received questions performed substantially better on a measure of retention than low ability subjects who received questions. There was no difference between high and low ability subjects when questions were omitted. The findings of Rothkopf (1972b), unlike those of these two studies support the conclusion that students with low ability benefited more from interspersed questions than more able students. These findings are more congruent with the more consistent reports of a strong enhancing effect upon the text learning of low aptitude students from materials with adjunct aids or some other form of induced mediational processing.

Prior knowledge and adjunct aids. Another subject characteristic which may interact with instructional methods or materials is the subjects' prior knowledge of the subject matter. That text difficulty is to a great extent determined by what the reader already knows and the text content is no surprise. Rothkopf (1972a, p. 318) suggests that

high correlations between cloze scores and measures of readability indicate that highly readable passages tend to be passages about which the reader knows a great deal. He states that the control of the reader's prior knowledge is a key problem to whether readability (reading ease) predicts learnability (learning ease). But Rothkopf does not feel that readability necessarily predicts learnability in adults provided that inspection time is not limited. With appropriate processing activities, readers in self-paced situations can handle a variety of difficulty levels and reduce them to the same level of internal representation (p. 320). "Appropriate processing activities" may result from mathemagenic (study or inspection) behaviors induced by external events such as adjunct questions. In fact, Rothkopf and Billington (1975) have devised an equation ($P=f(E,mT)$) to express the relation between experience (E), or prior knowledge, mathemagenic behaviors (m), or processing effort, and a test factor (T) on the performance by the reader on a test item (P), which is a measure of learnability. When E is high, difficulty is low. In general, greater values of m are required to yield the same performance level as E decreases.

Apparently, greater effort on the part of the reader must be expended in order to understand or learn more unfamiliar material. Similarly, researchers of achievement-treatment interactions such as Tobias (1976) suggest that the higher the level of prior achievement of the learner, the lower the instructional support needed to accomplish instructional objectives. As the level of prior achievement decreases, the amount of instructional support needed increases. Tobias

explains that "prior achievement," unlike "instructional support" is easily defined by pretest scores. Minimal instructional support amounts to just presenting the unmodified materials to the students. Support is increased by such means as editing, providing instructional objectives, and providing feedback.

Research evidence suggests that methods of instructional support such as various response modes in programmed instruction can influence the processing of text by readers varying in prior knowledge of the subject matter. In a study with college students by Abramson and Kagen (1975), unfamiliar material consisted of a program on diagnosing heart disease. Half of the group was familiarized with the content and then all subjects were assigned to either a low support treatment (reading) or a high support treatment (constructing responses, i.e., writing answers and receiving feedback). Results supported the notion that constructing responses leads to higher achievement compared to achievement from a reading mode when the material is unfamiliar. Also, students receiving prefamiliarization (especially with drawings) achieved superior scores when the learning program followed a reading mode. However, the same prefamiliarization led to lower achievement when followed by the constructed response mode.

In a similar experiment using programmed materials but with elementary school students, Tobias and Ingber (1976) tested the hypothesis that a constructing response mode with feedback should be more beneficial to students with low levels of prior knowledge. Also, students with a high level of prior knowledge should achieve as much by reading without instructional support. The results confirmed this expectation.

Those with low pretest scores achieved superior achievement with the constructed response mode (support) but as pretest scores increased, the differences between the reading and constructing groups' posttest scores decreased.

It would appear that one "appropriate processing activity" which enables a reader to understand and learn difficult (unfamiliar) text is the constructing response mode of programmed instruction. Another may be in providing the reader with adjacent-to-text activities. Such adjunct activities provide for an overt form of responding to text which should induce selective attention to certain text portions through the use of reading comprehension skills. One would expect students with lower levels of prior knowledge of the subject matter of the materials to benefit more from receiving the support of adjacent activities while reading than students who are familiar with the text subject matter.

Summary of the Literature

Attempts have been made to provide poor readers and other readers whose comprehension of text could be improved with various reading or study strategies. Attempts have been made to directly induce readers to use strategies such as visual imagery, advance or cognitive organizers, and study techniques. Materials have been altered by presenting words in phrase groupings, deleting words or adding words as distractors, underlining text portions, and adding headings, outlines, interspersed questions, and instructional objectives. Some of these aids to invoke the use of a strategy were found to improve readers' text comprehension, especially for those who are poor readers.

While the use of strategies invoked by some adjunct aids apparently does improve the comprehension and learning of some readers, materials must be altered to incorporate the aids or someone must be present to direct or remind the reader to use a particular strategy. Another limitation to providing adjunct aids to invoke the use of particular reading strategies is that some readers may need training in prerequisite skills before successfully using a particular strategy. Children have been given training in imagery skills before being instructed to employ an imagery strategy while reading prose. Others have been taught outlining skills to use when performing memorization tasks.

The possibility that using certain types of adjunct aids might have a training effect by providing practice in the use of skills associated with a particular aid was not supported in studies by Spiegel and Mayer. Adjunct aids appear to function to activate selective attention, or to establish a set to learn. Two of these aids have been found to be very effective in directing attention: interspersed questions and instructional objectives. The present investigator designed a technique to improve readers' comprehension skills which capitalized upon the attention directing function of adjunct aids. The training materials incorporate a type of aid called adjacent-to-text activities. Adjacent-to-text activities resemble interspersed questions both in format, although the activities are much more varied and unsystematic, and function. The use of the adjacent-to-text activities should improve readers' comprehension of text content because specific portions of text are processed when the reader actively responds to the activities. Skill development, or the training in the use of skills, was expected to occur through

reading and responding to the written instructions and application exercises of the adjacent-to-text activities.

A review of research studies was the basis for concluding that poor readers may benefit more from the more active, overt form of responding to adjunct activities than higher ability students. Likewise, students with lower levels of background knowledge of the content may comprehend the content better with the support of adjunct instructional activities. Students with higher comprehension abilities and higher levels of background knowledge may not learn more with the support of activities than by reading without support.

Further support for a study designed to examine the effect of adjacent-to-text activities on readers' comprehension skill development and comprehension of text content is provided by the results of a preliminary experimental study conducted by the present investigator. While research evidence provided a basis for the technique used to teach skills-in-text, i.e., the use of adjacent-to-text materials, it was not known how teachers and students would receive the materials.

THE PRELIMINARY STUDY*

The preliminary study served four main functions. The first was to test the effect of the use of specific materials with adjacent-to-text activities on fifth graders' reading comprehension skill development and comprehension of text content. The second was to examine whether some readers would benefit more or less from the use of the

*The preliminary study discussed below is presented in total in A trial of materials designed to improve readers' comprehension skills. Working Paper No. 230. Madison: Wisconsin Research and Development Center for Individualized Schooling, 1978.

comprehension materials in relation to their prior knowledge of text-related concepts or prior proficiency in the use of reading comprehension skills. The third was to obtain data in the form of students' responses to four multiple choice tests of text content comprehension. From these data, reliability coefficients, or measures of internal consistency were computed and an analysis of the difficulty and discriminability of each test question was performed. The fourth was to obtain information as to teachers' and students' receptiveness to the materials including suggestions concerning the use of the materials that might affect future modifications of the materials and further experimentation.

Method

Subjects. Two school populations in neighboring communities located in west central Wisconsin comprised the sample of 148 fifth graders. One school population consisted of 45 students in one school and 27 in another school in a medium size city. The remaining 76 students of the second school population were from three classrooms in the elementary school in a rural community. The students were classified as above or below their school mean on a measure of prior proficiency in the use of reading comprehension skills. Equal proportions of students above and below the mean in each school were randomly assigned to one of two treatments or a control group, resulting in three groups per school.

Materials. The treatment materials were an earlier edition of those used in the present study and consisted of a supplementary reader,

adjacent-to-text activities, and written feedback in the form of written answers or sample answers to the adjacent-to-text activities. Test instruments used were a test of knowledge of concepts which are related to the subject matter of the supplementary reader and two forms of a criterion referenced test of reading comprehension skill development. The set of skills tested by the latter instrument are the same as the set of skills incorporated for development within the adjacent-to-text activities.

Procedures. Prior to assignment to groups, the students took the test of prior knowledge and one form of the test of reading comprehension skill development. Results from the second test were used as the measure of students' prior proficiency in the use of reading comprehension skills. Students in one treatment group used adjacent-to-text activities while reading the text. A second treatment group checked their responses to the adjacent-to-text activities with answer keys. A third, or control, group read the text but did not receive adjacent-to-text activities. All test instruments were administered by the five classroom teachers involved in the execution of the preliminary study. Likewise, all treatment sessions were conducted by the classroom teachers. The students were given directions in oral and written form. Each worked individually and at their own rate within predetermined completion points throughout the course of treatment. At the end of the time allotted for each of four sections of the treatment materials, a test of text content comprehension was administered. Upon completion of all treatment sessions, the alternate form of the measure of reading

comprehension skill development was administered.

Analyses of Data. Four planned orthogonal comparisons were performed with analyses of covariance of the raw scores on the two dependent measures: two per dependent measure. The measure of skill development was the total score of tests of skill in applying context clues, identifying central thoughts, identifying correct conclusions, and determining the order of events. The measure of text content comprehension was the last of the four tests of content comprehension.

Results. Results showed that there were no significant differences between the experimental and control groups for the two schools on measures of skill development and content comprehension. Students who received adjacent-to-text activities while reading did not perform significantly better than those who did not receive the activities. Also, receiving written feedback in the form of an answer key did not significantly improve the scores of those receiving the adjacent-to-text activities. There was no discernable pattern in the data to indicate that receiving text with adjacent-to-text activities was more or less beneficial for certain sub-groups, i.e., those scoring above or below each school mean on a measure of prior proficiency in reading comprehension skills and those scoring above or below the school mean on a measure of prior knowledge of text-related concepts. There was no evidence that those in the two skill development groups began to apply skills to parts of text not having the support of activities towards the end of treatment.

At the conclusion of the study, the teachers involved in the

execution of the preliminary study were interviewed. In general, the teachers and students were receptive to the adjacent-to-text technique. Students were enthusiastic at first but their interest dropped drastically after the first two weeks. The total treatment time appeared to be too long. There may have been too much testing. Poorer readers found the materials to be difficult and did not always have time to finish.

The comments of the teachers in one school community were more positive towards the technique than those in the other school community. Those with the more favorable comments thought that the students using adjacent-to-text activities learned more than those who just read the supplementary reader. They liked the "set-up" with the line markers and numbers in text margins that served to direct students to the appropriate text portions while using the activities. These teachers planned to use the materials the following year. The teachers from both schools experienced the drawbacks to the use of the materials which were summarized above. The teachers gave suggestions regarding changes which could be made in the materials and in the design of future experiments.

Implications

Despite the nonsignificant results from the statistical analyses of the preliminary study data, the attitude of teachers and students towards the materials was quite favorable. Information was gained to use in designing a study to more adequately test the effectiveness of the adjacent-to-text technique. Factors to be considered in planning the study to follow were the following: 1) maintaining student

interest, 2) limiting the amount of testing, 3) eliminating a possible ceiling effect on the test of reading comprehension skill development, 4) further standardizing treatment administration, 5) revising the content comprehension test questions to lower the difficulty and to improve the discriminability of correct options and distractors of many of the test items, and 6) deciding when to have the students use the materials, e.g., social studies, science, or reading period.

HYPOTHESES AND RELATED QUESTIONS

Based upon research evidence and practical considerations, a set of reading comprehension skill development materials was developed with an adjunct aid format. Use of the materials was intended to improve upper-elementary grade readers' skills and text comprehension. Results of a preliminary study, despite no significant differences between group means on the two dependent variables, were encouraging. The materials were usable and teachers and students were receptive of the adjacent-to-text technique. Based on these findings, the following hypotheses and questions were formulated to test the effectiveness of using the materials.

Hypotheses 1 and 2

Many readers lack reading comprehension skills necessary for adequate comprehension of text. But skills are often taught in isolation from the act of reading an entire prose selection. The assumption underlying the present study is that skills could be taught in text by capitalizing upon the attentional direction function of adjunct aids. Materials with adjunct aids (adjacent-to-text activities) were developed. Because of instruction in skill use and application within the activities and because of the direct instructive effect of writing

responses to activities, it was expected that:

- (1) Students who use adjacent-to-text activities while reading will attain significantly higher scores on a measure of overall reading comprehension skill development than students who do not use adjacent-to-text activities while reading.
- (2) Students who use materials with adjacent-to-text activities while reading will score significantly higher on a test of content comprehension than students who do not use adjacent-to-text activities while reading.

Hypotheses 3 and 4

An answer key was produced containing suggested answers to adjacent-to-text activities. Knowledge of results, or feedback in the form of answers to adjunct questions has improved the learning of those given adjunct questions. It was predicted that:

- (3) Students who receive written feedback on appropriateness of responses to adjacent-to-text activities will attain significantly higher scores on a measure of overall reading comprehension skill development than students who do not receive written feedback on appropriateness of responses to adjacent-to-text activities.
- (4) Students who receive written feedback on appropriateness of responses to adjacent-to-text activities will score significantly higher on a test of content comprehension than students who do not receive written feedback on appropriateness of responses to adjacent-to-text activities.

Questions 1 and 2

Since researchers have reported that students with higher aptitudes, e.g., reading ability and prior knowledge of subject matter, may not benefit as much from receiving materials with adjunct aids as those with lower aptitudes, these questions were posed:

- (1) Was there evidence to suggest that good and poor readers differ in learning skills and comprehending text content when given text with adjacent-to-text activities?
- (2) Was there evidence to suggest that those above or below average on a measure of prior knowledge of text-related concepts differ in comprehending text content when given text with adjacent-to-text activities.

Question 3

Research results do not provide evidence that skills being applied with the support of adjunct aids to improve text comprehension will be applied to text segments without the direction of adjunct aids. But it would seem that from the training in using skills received from responding to adjacent-to-text activities, students might show evidence of applying those skills without assistance towards the end of the training period. The question posed was:

- (3) Was there evidence to suggest that students who use skill development, adjacent-to-text activities while reading begin to apply those skills to text without the assistance of adjacent-to-text activities? Or was there a decrease in the difference between intentional and incidental comprehension by the end of the training period?

In the chapter to follow, the method used to test the hypotheses and answer the questions posed is presented. The method includes a description of the subjects, materials, procedures, and analyses of data selected and used in the experiment. Because the present study was based upon and extends the preliminary study, reference is made to the earlier study throughout the method presentation.

II

METHOD

This study was designed to examine the effect of comprehension skill development materials on upper-elementary students' skill development and text comprehension. The materials provided skill instruction and application through the use of adjunct aids called adjacent-to-text activities. The experiment was conducted during the fall school semester to determine whether groups using the activities would perform better than a control group on measures of skill development and text comprehension. Comparisons on both measures were made between students who used the activities with written feedback and those who used activities without written feedback. Data were examined for suggestions of interactions between the treatments and two aptitude variables and for evidence of a trend in transferring skills without the support of the adjunct aids.

SUBJECTS

Three factors taken into consideration in selecting a population for the experiment were the following: 1) prior instruction in reading comprehension, 2) the relation between the difficulty level of the text and the subjects' level of reading ability, and 3) the geographical location.

Students in the preliminary study had attained high scores on a pretest of proficiency in the use of the comprehension skills to be trained through the use of the treatment materials. The students were not receiving instruction in the specific comprehension skills of concern to this study, but they were receiving instruction to improve their reading comprehension skills. For this reason, subjects were selected who were not receiving direct instruction to improve their comprehension of written prose materials.

The second factor was the match between the difficulty level of the comprehension materials and the students' reading ability. An application of the Dale-Chall readability formula based on average sentence length and percentage of unfamiliar words, i.e., those not on the Dale list of familiar words, indicated that the overall readability level of the text passages was in the seventh to eighth grade range. Whether materials used to teach comprehension skills should be difficult or easy to read is not known. An assumption of the present investigator is that materials used for reading instruction should be more difficult than materials used for the learning of content. This position is similar to a view presented by Guthrie (1977). He states that:

The language demands of the materials used for the purpose of teaching comprehension processes should be slightly higher than the language capabilities of the learners, since language instruction is essential to reading improvement. The

signposts of meaning should be absent and, rather, the children should be expected to impose them on the materials, in specifically planned classroom activities (p. 292).

There was some support for the assumption that materials used for comprehension skill development should be moderately difficult from results of an informal try-out of a portion of the adjacent-to-text materials and from the results of the preliminary study. A group of five fourth graders who were very good readers used the adjacent-to-text materials without difficulty. The teachers who took part in the preliminary study observed that the materials were difficult but not too difficult for the fifth graders. The teachers in one school believed that reading materials that are somewhat "tough" provide students with "something to come up to." The materials were too difficult for some students. But very poor readers were not eliminated from the preliminary study. For the present study, the conclusion was that if the poorest readers were not included in the sample, students in grades five or six would be appropriate as subjects for the present experiment. This population should be able to read the passages but also benefit from the skill development activities.

The final consideration in the selection process was the location of the sample. The school or schools had to be close enough to Madison, Wisconsin for those administering the study to be able to travel back and forth each day.

The sample population of 54 students was from three combination fifth-sixth grade classrooms. The school containing the classrooms is in a rural community near Madison, Wisconsin. Students were not receiving direct instruction to improve their reading comprehension skills. Nor had they received direct instruction in comprehension skills the preceding year. An individualized reading program is conducted within the language arts period; the students select and read books, write summaries or reviews of books, and have discussions with their teacher concerning the books they are reading. Those who were receiving reading instruction outside the regular classroom were not included in the experiment. The remaining students were classified as good, average, or poor readers by dividing a rank ordering of their reading achievement scores on the Sequential Tests of Educational Progress: Reading (STEP) into thirds. Also, teachers classified the students in their homerooms as good, average, and poor readers. Where discrepancies existed between the test score classification and teacher classification, the decision was based upon the latter judgment.

MATERIALS

The materials consisted of a set of comprehension materials created by the investigator and two commercial tests.

Comprehension Materials

The comprehension materials included expository materials, adjacent-to-text activities, answer keys to accompany the

activities, and tests of text content comprehension.

Expository materials. By writing and revising, expository prose passages containing certain environmental concepts with the central view that people are living organisms who adapt to and change their ecosystem were produced. The passages were reviewed by a specialist in environmental studies whose recommended changes were incorporated to ensure the authenticity of the text. There were four passages totalling seventy 8½ by 11-inch typewritten pages. A brief description of the four passages follows:

Passage 1, "Life in Ecosystems," explains some basic concepts of adaptation, interdependence, and the flow of energy in a pond, the arctic tundra, a desert, and a grassland environment. This section has approximately 5500 words. Several illustrations have been incorporated.

Passage 2, "The Kalahari: A Desert Ecosystem," provides a view of people adapting as hunter-gathers in a desert environment. The section has approximately 3000 words. A location map precedes the text.

Passage 3, "The Island of Java: A Tropical Ecosystem," shows how people have altered and maintained ecosystems using traditional agriculture. The section has approximately 3500 words. A location map precedes the text.

Passage 4, "New Orleans" A Cypress Swamp Ecosystem," emphasizes the complex set of changes produced by an industrial

culture. The section has approximately 5000 words. A location map precedes the text.

The expository materials are in Appendix A. The passages are included in one booklet with the title Living Environments: Animals, Plants, and People. The booklet is referred to as the "environmental reader."

A major concern throughout the process of producing the passages was to control the text difficulty so that children at about the fifth grade level could read them without becoming too frustrated but yet be difficult enough so that applying specific skills would aid the comprehension of the materials. The steps followed to control the text difficulty were the following:

1. The number of concepts was limited. For example, in revising the text, the concepts of "cycle" and "population" were eliminated.
2. A suitable readability level was established. The Dale-Chall readability formula was applied to systematically randomized portions of the text on two different occasions. The grade levels indicated by this formula, based on average sentence length and percentage of unfamiliar words (those not on the Dale list of familiar words), for each passage are 7-8, 7-8, 5-6, and 7-8 respectively.
3. Activities to help readers understand the text were written. An assumption was that providing readers with

activities to assist them in applying reading comprehension skills to somewhat difficult content would reduce the difficulty in processing that content.

Some attention was given to implanting the specific structures, e.g., prefixes, topic sentences, to be used in developing skills. Since these structures are found in the normal flow of prose, the emphasis was on identifying the structure to be used for developing the specific skills of concern to this study and adding some where appropriate. Steps followed to implant structures were the following:

1. The incorporation of markers, i.e., cue words such as first, soon, finally, where appropriate.
2. The incorporation of explicitly stated topic sentences.
3. The definition of words judged to be unfamiliar to those reading the materials with context clues.

A final step was to draw line markers in the right margins of the text pages to encompass text information relevant to adjacent activities. Numbers were placed next to the line markers to identify each text segment with its corresponding skill development activity.

Results of the preliminary study revealed several inaccuracies in the line markers and a few typographical errors. Corrections were made to eliminate these errors.

Adjacent-to-text activities. A set of activities were developed to accompany each text passage. The activities are in the form of an adjunct aid designated as adjacent-to-text activities. The four sets of activities are in Appendix B.

The activities were designed to develop the Level E reading comprehension skills identified for the Wisconsin Design for Reading Skill Development: Comprehension (1977). The Level E Design skills and objectives are:

Skill 1 -- Prefixes

Objective: The child recognizes that a prefix is a meaning-bearing unit that can modify the meaning of a word by signifying one of the following: range, time, number, approval or support, disapproval or opposition.

Skill 2 -- Direct Clues: Application

Objective: The child determines the meaning of an unfamiliar word in a context which contains explicit clues (e.g., synonym, definition, equivalent phrase, summary) and then applies that meaning in a second context where the same unfamiliar word appears but no explicit clues are present.

Skill 3 -- Detail: Clauses

Objective: The child attends to detail in sentences which contain no more than two subordinate clauses.

Skill 4 -- Paraphrase: Complex Sentences

Objective: The child restates sentences which contain no more than two subordinate clauses by rearranging and/or substituting for more than a short phrase.

Skill 5 -- Central Thought: With Organizer

Objective: The child identifies a central thought of a passage that contains an organizer (topic sentence) and both relevant and irrelevant information.

Skill 6 -- Conclusions: Direct Relationships

Objective: The child identifies relationships that are directly stated in a passage and then determines whether give conclusions based on those relationships are right or wrong. (A relationship that is directly stated is one that is given in a single statement.)

Skill 7 -- Explicit Cues

Objective: Given a written passage, the child determines the order of specific events when the order is indicated by explicit sequential markers (e.g., next, finally).

Before designing the activities, text segments were analyzed to determine which skill or skills would enhance the comprehension of that particular text segment. Activities were written to provide explanations and directions to the students while applying the skill or skills to the particular text segments.

Three types of activities were developed: activities that direct readers to read, draw, or answer a question or questions. Where an activity directs a student to read, a short explanation of a specific reading comprehension skill is presented. An example follows: "Note: When you come to a word that you don't know you can often figure out the meaning of the new word. The words near the new word can help you out. These helping words are called context clues. They are clues, or hints to the meaning of a word." Occasionally, the student is asked to draw a picture to enhance or demonstrate understanding of a skill applied in text. Within the same activity or in other activities, the reader may be asked to write or select one word, a short answer, one sentence, or more than one sentence in response to questions designed to relate the context of the "environmental reader"

to a particular skill or skills. The questions are classified into 13 categories. The frequencies of utilization of question types and response units required, i.e., one word, short answer, one sentence, or more than one sentence, are in Table 1.

Each activity is designed to develop one or more of the six Level E Design skills. The skill or skills associated with each activity are identified in Appendix C. The frequencies of use of each skill within each set of activities are in Table 2. The total proportions for the six skills used in the entire set of activities are also in Table 2.

The reason for having only five percent of the activities designed to teach the identification of prefixes is that there are few suitable prefixes, i.e., those identified as appropriate for the Design, Level E prefixes skill, in the text. Since the activities vary in length and in the amount of effort expected of the student, the numbers in Table 2 should be interpreted as gross estimates of the apportionment of skills to activities.

The original intention had been to use a split-page format, with text on the left side and adjacent activities on the right. For practical reasons, e.g., not enough space, uneven distribution of activities, the decision was made to produce the adjacent-to-text activities as four separate booklets to accompany the four passages of the "environmental reader."

Answer keys. Four sets of answer keys were produced each to accompany one section of adjacent-to-text activities. For activ-

TABLE 1
TYPES OF ADJACENT-TO-TEXT ACTIVITIES

I. Read an explanation of a reading comprehension skill (19)					
II. Draw (15)					
III. Answer questions (write or select) (335)					
Categories of Questions	Units of Responding to Questions				Total
	One Word	Short Answer	One Sentence	More than one sentence	
1. Define a word	2	25	6	3	36
2. Wh-questions (what, where, when, who why, how, which)	27	48	25		100
3. Yes-No questions	10				10
4. Categorize	10				10
5. Name	29				29
6. Sentence completion	40	25			65
7. Identify correct paraphrase			20		20
8. Identify topical information		11	3		14
9. Identify a topic		14	6		20
10. Identify central thought information			1	4	5
11. Identify a central thought			4	4	8
12. Identify a conclusion		2	6		8
13. Denote a correct sequence	4	1	2	3	10
Totals	122	126	73	14	335

TABLE 2
FREQUENCIES AND PROPORTIONS OF SKILL UTILIZATION
IN FOUR SETS OF ACTIVITIES

Skill	Environmental Reader Sections				Totals	
	Life in Ecosystems	The Kalahari	Java	New Orleans	No.	%
Identify word parts prefixes	2	3	2	6	13	04.6
Apply context clues	19	8	19	12	58	20.7
Attend to sentence detail	11	12	16	15	54	19.3
Substitute and or rearrange words in sentences	8	10	6	7	31	11.1
Identify central thought	18	11	9	14	52	18.6
Identify correct conclusions	12	12	13	9	46	16.4
determine order	7	4	10	5		
					26	09.3
					280	

ities with more than one possible response, sample answers were presented. The answer keys are in Appendix D.

Content comprehension tests. For each section of the four sets of adjacent-to-text materials, a multiple-choice test was developed to test the student's comprehension of the environmental text. The four tests are in Appendix E. Each test question has four options, one correct option and three distractors. To ensure that the questions would be representative of the text content and of the various skills applied while reading, the following steps were taken. A matched pair of questions was written for about every two pages of text. Each pair was written to elicit a directed or spontaneous application of one of the comprehension skills. One pair member has content that had the particular skill applied via an adjacent-to-text activity. These are called intentional comprehension items. The other pair member has content in the same textual vicinity where the same skill could be applied, but had not been directly applied via an adjacent-to-text activity. These are called incidental comprehension items. Even-numbered items are intentional comprehension items. Odd-numbered items are incidental comprehension items. The number and proportion of test items per skill category are in Table 3.

From the preliminary study, reliability and item analysis statistics were computed for the four tests of content comprehension. To estimate the degree of internal consistency and item difficulty and discriminability of the tests, the LERTAP (Laboratory of Educational Research Test Analysis Package) was used. The analysis of posttest

TABLE 3

CONTENT COMPREHENSION TESTS -- TEST CONSTRUCTION
SKILL CATEGORIES AND NUMBER OF ITEMS PER CATEGORY

SKILL	Test 1 (Life in Ecosystems)	Test 2 (Kalahari Desert)	Test 3 (Java)	Test 4 (New Orleans)	No.	%
Identifies word parts	2	0	2	0	4	3.7
Apply Context Clues	8	6	2	6	22	20.3
Attend to sentence detail	6	2	4	8	20	18.5
Substitute and/or rearrange words in sentences	2	4	4	2	12	11.1
Identify central thought	8	6	2	6	22	20.3
Identify correct conclusions	6	4	6	6	22	20.3
Determine order	2	2	2	0	6	5.5
Totals	34	24	24	28	108	1.0
Incidental	17	11	12	14	54	
Intentional	17	11	12	14	54	

scores yielded Hoyt reliability coefficients for the four posttests of .93 ("Ecosystems"), .91 ("Kalahari"), .85 ("Java"), and .79 ("New Orleans") and an overall reliability coefficient of .96. According to Mehrens and Lehmann (1973), a reliability coefficient of about .65 is sufficient for group decisions. Therefore, these coefficients are adequate. Items with difficulty indexes between .50 and .80 were considered appropriate. The item analysis indicated that some of the items were too hard, i.e., less than 50 percent correct responses. The point biserial correlation coefficient for each item was examined. Items were acceptable if the coefficient was in the range of .70 or .80 for the correct option and $-.20$ or $-.30$, or at least negative, for the incorrect distractors. Some items did not sufficiently discriminate between good and poor students on the correct response and many items did not have appropriate distractors. Items which were judged as too difficult and/or lacking in acceptable indexes of discriminability were revised. Most of the changes in the items involved changing one or more of the options, usually the incorrect distractors that were too attractive. Occasionally a stem was reworded.

Measurement Instruments

Three measurement instruments were used in the experiment. One instrument is described above under Comprehension Materials and is the test of text content comprehension.

Another instrument is a test of prior knowledge of text-related concepts. Background knowledge of environmental concepts was assessed in terms of performance on the Level V Environmental Cognitive Inventory

developed by Project I-C-E (Instruction-Curriculum-Environment), Greenbay, Wisconsin (or I-C-E test). The test consists of 44 multiple choice questions. The test measures knowledge of the following concepts:

1. The sun is a basic source of energy on earth. Transformation of sun energy to other energy forms (often begun by plant photosynthesis) provides food, fuel, and power for life systems and machines.
2. All living organisms interact among themselves and their environment, forming an intricate unit called an ecosystem.
3. Environmental factors are limiting on the numbers of organisms living within their influence. Thus, each ecosystem has a carrying capacity.
4. An adequate supply of clean water is essential to life.
5. An adequate supply of clean air is essential for life.
6. The distribution of natural resources and the interaction of physical environmental factors greatly affect the quality of life.
7. Factors such as facilitating transportation, economic conditions, population growth, and increased leisure time influence changes in land use and population densities.
8. Cultural, economic, social, and political factors determine man's values and attitudes toward the environment.
9. Man has the ability to manage, manipulate, and change his environment.
10. Short-term economic gains may produce long-term environmental losses.
11. Individual acts, duplicated or compounded, produce significant environmental alterations over time.
12. Each person must exercise stewardship of the earth for the benefit of mankind.

The test developers used both experimental subjects (those using the environmental curriculum materials) and control subjects to determine the reliability, or degree of internal consistency of the test. The reliabilities presented in Table 4 are considered to be unusually high as environmental tests have proven to be extremely difficult to construct due to the generality of the concepts covered.

Table 4
MEANS, STANDARD DEVIATIONS AND RELIABILITIES
OF I-C-E CONCEPTS TESTS (GRADE 5)

	Pre-test Experimental-Control	Post-test Experimental Control	
N	459	163	155
X	17.50	20.57	19.59
SD	4.82	5.96	5.69
R	.62	.76	.73

The third instrument is the test of reading comprehension skill proficiency. The test includes four of the seven Level E tests of the Wisconsin Tests of Reading Skill Development: Comprehension (1977), forms P and Q. In an abbreviated form, the four skills involve the 1) identification of explicit context clues, 2) identification of a central thought for a passage with an organizer (topic sentence), 3) identification of a conclusion for a passage with a directly stated relationship and 4) determination of the sequence of events in a passage with explicit sequential markers.

The Design Level E comprehension skill tests consist of two parallel forms, P and Q. A multiple-choice format is used for five of the tests. As may be seen in Table 5, for the population that tried out the Level E Design comprehension tests, reliabilities and proportions of correct responses on the four tests are high.*

TABLE 5
1977 COMMERCIAL EDITION OF WTRSD: COMPREHENSION
ESTIMATED SUMMARY STATISTICS FOR FORMS P AND Q

Test	Test Form	No. of Items	Raw Score	Std. Dev.	r	Percent Correct
1. Direct Clues Application	P	14	10.78	3.09	.83	77.0
	Q					
2. Central Thought	P	15	12.55	2.72	.79	83.7
	Q		12.58	2.73		
3. Conclusions	P	20	15.75	3.46	.77	78.7
	Q		15.81	3.59		
4. Explicit Cues	P	15	11.13	3.63	.84	74.2
	Q		10.73	3.97		

*A description of the try-out population, summary statistics, and reliability procedures and results for the Level E Design tests is presented in a working paper, Preliminary Technical Manual for Forms P and Q of the Wisconsin Tests of Reading Skill Development: Comprehension. Research and Development Center for Cognitive Learning, University of Wisconsin, Madison, Wis., December, 1976.

The decision to select the four particular skills identified above and to use both test forms (P and Q) was based upon results of the preliminary study. The test of the use of prefixes had been eliminated from consideration as responses to this skill test are subjectively evaluated. The two sentence meaning skills, detail and paraphrase, were eliminated because the students of one school population in the preliminary study received very high scores on the form P tests of these skills which were administered as pretests. The purpose of selecting the four remaining tests was to counteract a possible ceiling effect by which the tests might not allow students to fully demonstrate their knowledge. Another precaution taken was to administer both forms of the four selected tests in order to double the number of test items. Increasing the length of a test also has the effect of increasing the reliability of a measurement instrument. Consequently, the number of items per skill test was as follows:

1) Context-Direct Clues: Application -- 28 items, 2) Central Thought: With Organizer -- 30 items, 3) Conclusions: Direct Relationships -- 40 items, and 4) Sequence - Explicit cues -- 30 items.

PROCEDURES

The experiment was conducted during October and November, 1977. Six employees, including the investigator, of the Wisconsin Research and Development Center for Individualized Schooling in Madison administered all tests and presented all of the directions to the experimental groups. All treatment sessions of each experimental group were monitored by a member of the R & D Center. A rotation system was

followed. Each member took turns conducting the sessions of each of the experimental groups.

Pretreatment Procedures

The three classroom teachers and the investigator met to compose a letter asking for each parent's permission for their child to participate in the experiment. All of the parents gave their consent. The teachers and the investigator also made a schedule of the time periods to be used for experimental sessions over a 25 day period. The investigator met with the entire group of students for 15 minutes to explain the purpose for the study, the procedures to be followed, and how their participation could be of value to themselves.

Three experimental groups each containing good, average, and poor readers were formed. Students within each classification of reading ability were randomly assigned to one of the three groups. Each group had 18 subjects and met in one of the three classrooms for all sessions.

On the first day of the study the students took the I-C-E test of prior knowledge of text-related concepts. The total time involved in administering the test was 45 minutes.

Treatment Procedures

The students met in their assigned group every school day for 45 minutes during the social studies time block. The block consisted of one 15 minute period followed by a 45 minute break where the students went to another class and then a 30 minute period. Total time spent using the treatment materials was 14.5 hours. With the exception of the first of the four sections of the treatment materials (Passage 1,

"Life in Ecosystems: and accompanying materials), five days were allotted per section. Two extra days were scheduled for the first section because it has more pages of text and more activities. Also, an initial training session for those using the adjacent-to-text materials was conducted. For the remaining sections, four days were spent on reading and doing the adjacent-to-text activities. On the fifth day, students spent the first 15 minutes working on the materials and then took a content comprehension test during the final 30 minute period.

There were two treatment groups and one control group. Students in one group (ACTIVITIES) received adjacent-to-text activities while reading the text. A second group (FEEDBACK) checked their responses to the adjacent-to-text activities with answer keys. A third, or control group (READ) read the text but did not receive adjacent-to-text activities.

Directions for all groups were given in both written and oral forms for the initial break-in session for the first section of the materials and prior to the beginning of each of the next three sections. All directions are in Appendix F. The oral versions were recorded on tape. The students read the directions silently while listening to the tape recorded version. During the break-in session, each student's work was checked to determine whether he or she understood the adjacent-to-text technique. Assistance was provided where needed. After the initial break-in session, those monitoring the treatment sessions provided the pro-

nunciation of words when requested. A chart was displayed each day to remind students in the ACTIVITIES and FEEDBACK groups of the procedures to follow. Students who finished a section of the materials early read their library books. The students worked individually and at their own pace. Students in the control group were given the "environmental reader" during each treatment session. The READ group was encouraged to review on the day before a test of content comprehension was to be administered.

The investigator believed that a true test of treatment effects would not occur unless the subjects were motivated to do their best work. As explained in the first chapter, the students in the preliminary study exhibited a drop in interest after the first two weeks of treatment. This was not surprising. The students were not allowed to discuss the materials with their classmates and teachers and they could not work together. The teachers could not provide supplementary activities to clarify and extend ideas presented in the passages. A teacher can use various techniques to initiate and direct students' interests. In the present study, students were given tangible rewards as an incentive to do their best work. The students in each group were able to earn a reward upon completion of each of the four sections of the materials. To earn a reward, the student had to receive a check next to his or her name for each day spent working on a section. A check indicated that the student had not wasted time but had worked "diligently." The reward for each of the first three sections was a felt-tip pen. For the last section, a pad of paper could be earned.

The students were told about the reward system in advance and their teachers reported that they were very interested in earning them.

Measurement of Treatment Effects

The last of the four tests of content comprehension was the measure of treatment effects on text content comprehension. This test was administered on the fifth day of the use of the last section of the materials, "New Orleans -- A Cypress Swamp Ecosystem." The students were given a one day break before the measure of skill development was administered. After the break, Forms P and Q of the four selected Design tests were given over a period of three days. The scheduled time periods for conducting the treatment sessions were also used for the testing. Those who were absent during part of the testing were given the tests the following week by the investigator.

ANALYSES OF DATA

To determine if there were differences between the mean scores of the three groups in reading comprehension skill development and text comprehension after treatment, four planned orthogonal comparisons were computed, two per dependent variable. The conceptual unit for the error rate in making a Type I error (or incorrectly rejecting the null hypothesis) for a priori orthogonal comparisons is typically the individual comparison, or testing each comparison at the alpha level of significance rather than splitting the alpha level between comparisons. Rather than set the alpha level at .01 or .05, the investigator decided that .10 would be more appro-

priate for these analyses. This study was exploratory, intended to guide further refinements of materials and measuring instruments. It was not intended to build or extend theory per se, although the results of theory building research were important to the design of the materials of concern to this study and to the questions posed. Also, the reactions of teachers and others who have examined the materials led the investigator to believe that a situation where the null hypothesis is incorrectly accepted (Type II error) was of greater concern than incorrectly concluding that true mean differences did occur (Type I error).

The first dependent variable was the measure of skill development, the four Design tests of reading comprehension skill development, forms P and Q. The measures were students' total number of correct responses on the set of tests with a possible total score of 128. The orthogonal, or nonoverlapping comparisons on this measure were computed by a one-way analysis of variance. The two comparisons performed on the comprehension skill development data were determined before conducting the experiment and are shown below.

Comparison	Coefficients			Hypothesis
	ACTIVITIES	FEEDBACK	READ	
$\hat{\Psi}_1$	$\frac{1}{2}(\bar{X})$	$\frac{1}{2}(\bar{X})$	$-1(\bar{X})$	$\frac{1}{2}(\mu A + \mu F) - \mu R$
$\hat{\Psi}_2$	$-1(\bar{X})$	$1(\bar{X})$	$0(\bar{X})$	$\mu F - \mu A$

The second dependent variable was the measure of content comprehension for the fourth section of the materials ("New Orleans"). The orthogonal comparisons of groups' scores on the 28 item test of text content comprehension were computed by analysis of covariance. The covariate measure was students' scores on the 44 item test of prior knowledge (I-C-E test). The two comparisons performed on the measure of text content comprehension were determined before conducting the experiment and are shown below.

Comparison	Coefficients			Hypothesis
	ACTIVITIES	FEEDBACK	READ	
$\hat{\psi}_3$	$\frac{1}{2}(\bar{X})$	$\frac{1}{2}(\bar{X})$	$-1(\bar{X})$	$\frac{1}{2}(\mu A + \mu F) - \mu R$
$\hat{\psi}_4$	$-1(\bar{X})$	$1(\bar{X})$	$0(\bar{X})$	$\mu F - \mu A$

Three questions posed in the study were the following:

1. Did treatment effects on comprehension skill development differ for good and poor readers?
2. Did treatment effects on text content comprehension differ for those above or below the population mean score on the measure of prior knowledge of text-related concepts?

3. Did those who received adjacent-to-text activities apply the skills developed through the activities to text portions without the assistance of activities? In other words, was there a transfer of training effect indicated by a decrease in the difference between intentional and incidental test items across the four content comprehension tests?

There were not enough subjects to perform statistical tests of significance to answer the first two questions. There were six or seven per group of those classified as good or poor readers and from seven to eleven per group of those classified as above or below average in prior knowledge. The third question could not be answered with a repeated measures design because the four tests of content comprehension are not comparable or by trend analysis because data should not be overanalyzed. Instead, raw scores on the dependent measures were converted to percentages and are presented graphically. Differences between groups in proportions of correct responses on the measures are discussed in answering the questions.

In the following chapter, the results of the data analyses on the measures of skill development and text content comprehension are presented. A discussion follows each statement of a result or results.

III

RESULTS AND DISCUSSION

As indicated in Chapter II, differences among the three experimental groups were examined in terms of scores on two measures administered following the completion of the treatment. An analysis of variance was performed on the raw scores obtained from the test of reading comprehension skill development and an analysis of covariance was performed on the raw scores obtained from the test of text content comprehension. The covariate measure was the I-C-E test of prior knowledge of text-related concepts. The alpha level, or probability of incorrectly making a decision that the group means differ was set at .10.

In addition, related questions were answered descriptively with summarized scores for tests administered throughout the study. The scores on the tests were converted to percentages for the purpose of comparing the experimental groups.

Following data collection, an item analysis was performed on students' responses to questions of content comprehension. The tests were analyzed for internal consistency and item difficulty and discriminability. The LERTAP (Laboratory of Educational Research Test Analysis Package) was used. For the fourth test, "New Orleans," which comprised the measure of content comprehension following treatment, the analysis yielded a Hoyt reliability coefficient of .76. The item difficulty and discrimination indexes for the revised 28 item test

were more acceptable than those of the first version used in the preliminary study.

In presenting the data, each hypothesis is restated. Results and discussion are presented after each statement of an hypothesis. The questions are answered and discussed in the same manner.

HYPOTHESES

Hypothesis 1

The first hypothesis was a predication that the two treatment groups that used adjacent-to-text activities would outperform the control group on the measure of reading comprehension skill development.

- (1) Students who use adjacent-to-text activities while reading will attain significantly higher scores on a measure of overall reading comprehension skill development than students who do not use adjacent-to-text activities while reading.

Mean scores and standard deviations for the three groups are shown in Table 6.

TABLE 6
GROUP MEANS AND STANDARD DEVIATIONS ON OVERALL
READING COMPREHENSION SKILL DEVELOPMENT

Group	ACTIVITIES	FEEDBACK	READ
Mean*	107.22	107.67	102.05
Standard Deviation	17.62	18.64	23.37

*Total score possible of 128

Results of analysis of variance of scores on the measure of skill development indicated that the average mean of the two treatment groups was not significantly different ($\alpha = .10$) from the mean of the control group. The result of analysis of variance of scores on the measure of skill development is summarized in Table 7.

TABLE 7

ANALYSIS OF VARIANCE OF STUDENTS' SCORES ON A MEASURE OF
OVERALL SKILL DEVELOPMENT COMPARING THE AVERAGE
OF TWO TREATMENT GROUPS TO A CONTROL GROUP

<u>Source</u>	<u>df</u>	<u>MS</u>	<u>F</u>	<u>P</u>
ACTIVITIES + FEEDBACK				
versus	1	248.481	0.868	0.356
READ				
Error	51	401.296		

Based on this result, hypothesis 1 is not accepted. As indicated by the result, the use of comprehension materials with adjacent-to-text activities did not improve the reading comprehension skills of the fifth-sixth graders. The average mean score of the two treatment groups is greater than the mean score of the control group as predicted but the difference is not significant. These results are consistent with those of the preliminary study conducted by this investigator and with the results of the study by Spiegel (1976). She reported that training with modified materials including advance organizers or interspersed

questions followed by training in previewing for the advance organizer group and self-generated questions for the interspersed questions group did not improve the literal comprehension scores of average or poor eighth graders. In the Spiegel study, good readers did benefit from training in the use of interspersed questions.

Hypothesis 2

The second hypothesis was a prediction that the two treatment groups that used adjacent-to-text activities would outperform the control group on the measure of text content comprehension.

- (2) Students who use materials with adjacent-to-text activities while reading will score significantly higher on a test of content comprehension than students who do not use adjacent-to-text activities while reading.

Mean scores and standard deviations for the three groups are shown in Table 8.

TABLE 8
GROUP MEANS AND STANDARD DEVIATIONS ON A MEASURE OF
TEXT CONTENT COMPREHENSION

Group	ACTIVITIES	FEEDBACK	READ
Mean*	17.06	16.72	14.92
Standard Deviation	5.17	4.61	4.22

*Total possible score is 28

The result of an analysis of covariance of scores on the measure of content comprehension, adjusting for prior knowledge, is summarized in Table 9.

TABLE 9

ANALYSIS OF COVARIANCE OF STUDENTS' SCORES ON A MEASURE OF CONTENT COMPREHENSION ADJUSTING FOR PRIOR KNOWLEDGE TO COMPARE THE AVERAGE OF TWO TREATMENT GROUPS TO A CONTROL GROUP.

Source	<u>df</u>	<u>MS</u>	<u>F</u>	<u>P</u>
ACTIVITIES + FEEDBACK				
versus	1	58.743	3.914	0.0535*
READ				
Error	50	15.007		

*Significant ($\alpha = .10$)

As shown above, the second comparison indicated that the two means are significantly different. Hypothesis two was not rejected. On the basis of the result of the test of the second hypothesis, it appears that for this fifth-sixth grade population, using text with adjacent-to-text activities did improve readers' comprehension of text content.

This result differs from that of the preliminary study but is consistent with findings that interspersed questions and instructional objectives, both of which the adjacent-to-text activities resemble, have a direct instructive effect by improving intentional and perhaps incidental learning (Boker, 1973; Kaplan, 1974; Kaplan and Simmons, 1974;

Fraser, 1967, 1968; Rothkopf, 1966; Rothkopf and Bisbicos, 1967).

Hypotheses 3 and 4

Hypotheses 3 and 4 are predictions that the treatment group receiving written feedback in the form of an answer key would outperform the treatment group that did not receive written feedback on measures of skill development and text content comprehension.

- (3) Students who receive written feedback on appropriateness of responses to adjacent-to-text activities will attain significantly higher scores on a measure of overall reading comprehension skill development than students who do not receive written feedback on appropriateness of responses to adjacent-to-text activities.
- (4) Students who receive written feedback on appropriateness of responses to adjacent-to-text activities will score significantly higher on a test of content comprehension than students who do not receive written feedback on appropriateness of responses to adjacent-to-text activities.

The mean scores and standard deviations for the two groups are shown in Table 10.

TABLE 10
TREATMENT GROUPS' MEANS AND STANDARD DEVIATIONS ON
SKILL DEVELOPMENT AND TEXT CONTENT COMPREHENSION

Group	Skill Development		Text Comprehension	
	Mean*	St. Dev.	Mean**	St. Dev.
ACTIVITIES	107.22	17.62	17.06	5.17
FEEDBACK	107.67	18.64	16.72	4.61

* Possible score of 128

**Possible score of 28

The result of an analysis of variance of scores on the measure of skill development is summarized in Table 11.

TABLE 11

ANALYSIS OF VARIANCE OF STUDENTS' SCORES ON A MEASURE OF OVERALL SKILL DEVELOPMENT TO DETERMINE THE EFFECT OF FEEDBACK

<u>Source</u>	<u>df</u>	<u>MS</u>	<u>F</u>	<u>P</u>
FEEDBACK				
versus	1	1.778	0.004	0.947
ACTIVITIES				
Error	51	401.296		

The result of the comparison is not significant. Hypothesis three is not accepted.

The result of an analysis of covariance of scores on the measure of text content comprehension is summarized in Table 12.

TABLE 12

ANALYSIS OF COVARIANCE OF STUDENTS' SCORES ON A MEASURE OF TEXT
CONTENT COMPREHENSION, ADJUSTING FOR PRIOR KNOWLEDGE, TO DETERMINE
THE EFFECT OF FEEDBACK

<u>Source</u>	<u>df</u>	<u>MS</u>	<u>F</u>	<u>P</u>
FEEDBACK				
versus	1	5.186	.345	0.559
ACTIVITIES				
Error	50	15.007		

The result of the comparison is not significant. Hypothesis four is not accepted.

That providing students with written feedback did not improve the performance of students who used adjacent-to-text activities was unexpected, although this result agrees with the results of the preliminary study conducted by this investigation. Investigators have reported that giving readers knowledge of results in the form of answers to adjunct questions improves performances on tests of retention (Frase, 1967; Rothkopf, 1966; Rothkopf, 1972a). But the results of the present study differ from these findings and lend support to an alternative conjecture on the relation between feedback and adjunct questions. Frase (1967) suggested that, at least intuitively, supplying answers to adjunct questions should not be necessary because reading the relevant text material after the question should provide knowledge of results. Feedback may be redundant information which might even inter-

fere with text processing behaviors.

QUESTIONS

Question 1

To examine whether using adjacent-to-text activities with or without written feedback might be more or less beneficial for good or poor readers, the following question was posed:

- (1) Was there evidence to suggest that good and poor readers differ in learning skills and comprehending text content when given text with adjacent-to-text activities?

Skill development. Good readers in the ACTIVITIES and FEEDBACK groups did not differ on mean percentage of correct responses on a measure of overall skill development, as shown in Figure 2.

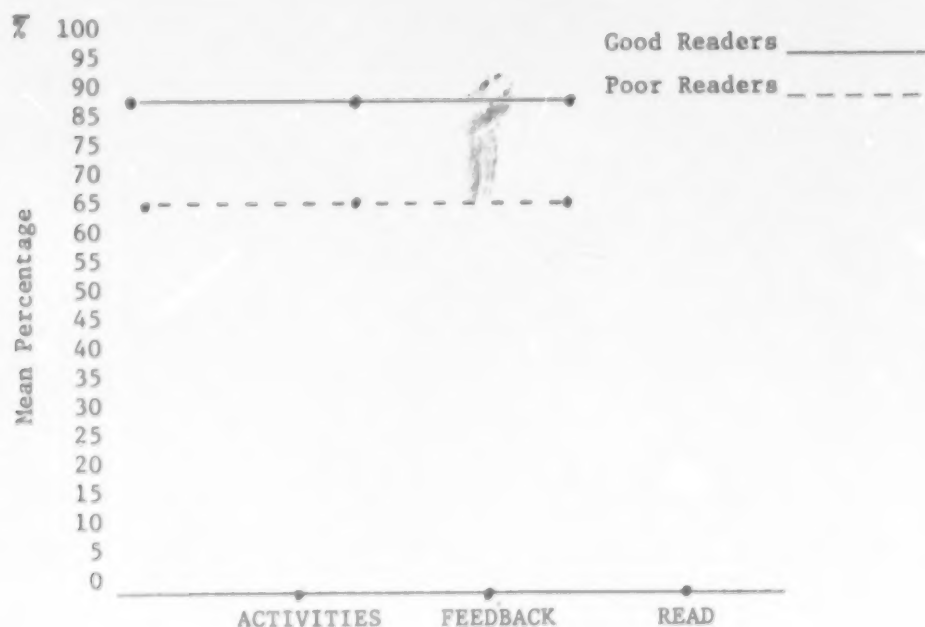


Figure 2. Good and poor readers' mean percentage of correct responses on a measure of overall skill development.

The good readers in the READ control group scored an average of one percent more correct answers than did those in the two treatment groups. For poor readers, the only difference was that those in the ACTIVITIES group scored an average of two percentage points fewer correct responses than did those in the FEEDBACK and READ conditions.

The three groups' mean percentage scores on the four separate tests of skill development which comprised the overall measure are shown in Figure 3 for good readers and Figure 4 for poor readers. As shown in Figure 3, there were few differences in mean percentage scores for good readers across the four tests or between groups on any of the tests. Poor readers did somewhat better on the central thought skill ($\bar{x}=74$) and the relationships/conclusions skill ($\bar{x}=73$) than on the context clues skill ($\bar{x}=68$) and on the sequence skill ($\bar{x}=64$). Poor readers in the ACTIVITIES and FEEDBACK groups were superior to poor readers in the READ group on the central thought skills ($\bar{x}s=75, 77$, and 68 respectively). But poor readers in the FEEDBACK group ($\bar{x}=77$) did better than poor readers in the other two groups on the relationships/conclusions skill. There was little difference between groups for poor readers on the context clues skill. There was no difference for poor readers between the ACTIVITIES group and FEEDBACK group on the sequence skill but the READ group's mean percentage of correct responses on this measure was 15 points higher than those of the two treatment groups.

In general, these results are in agreement with the nonsignificant results of the test of differences between the ACTIVITIES, FEEDBACK, and READ conditions on overall skill development. Good and poor

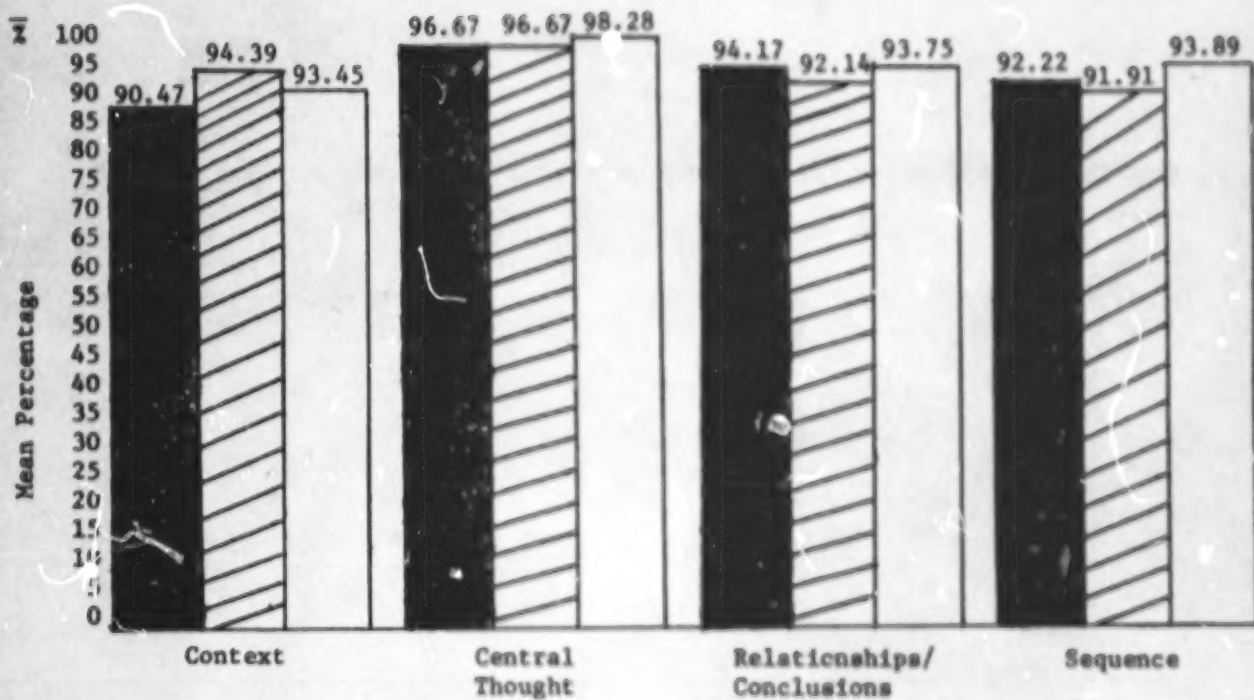


Figure 3. Good readers' mean percentage scores on four comprehension skills.



ACTIVITIES



FEEDBACK



READ

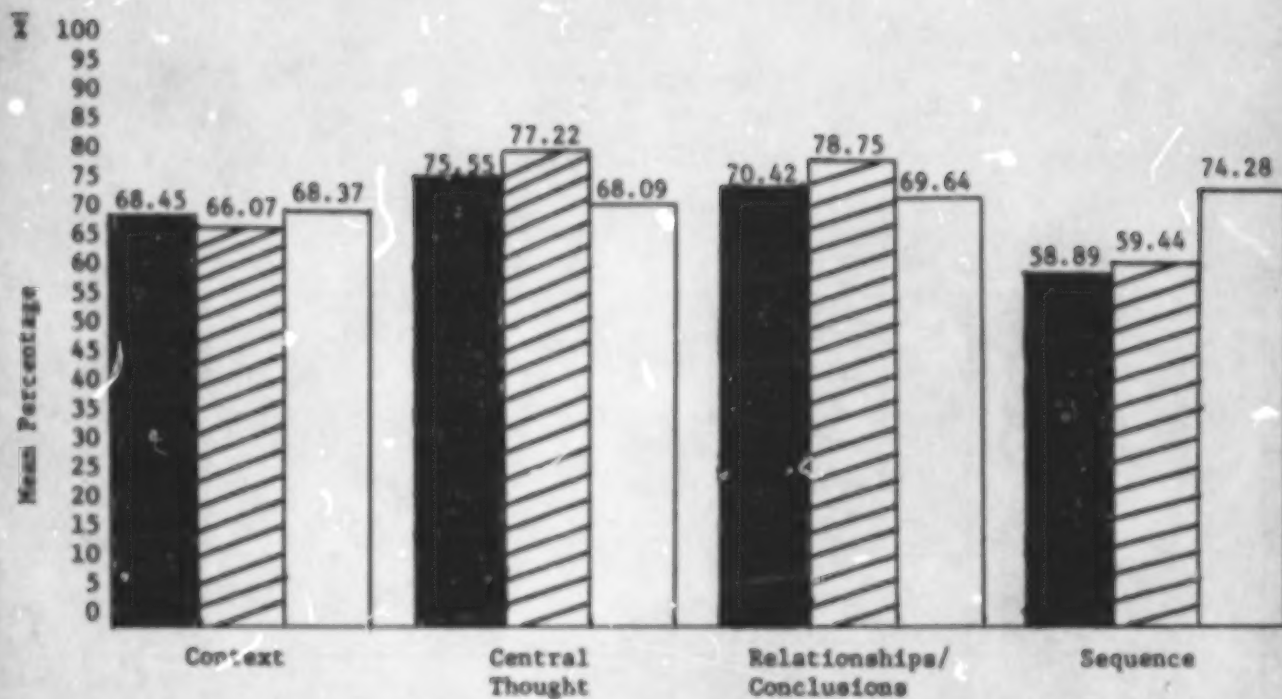


Figure 4. Poor readers' mean percentage scores on four comprehension skills.

 ACTIVITIES
  FEEDBACK
  READ

readers exhibited the same pattern, namely that the proportions of correct responses on the measures of skill development did not differ across the three treatment groups. Poor readers did exhibit a difference in favor of the two groups using activities while reading, but only on two of the four skills.

Content comprehension. As shown in Figure 5, the scores of good readers in the ACTIVITIES group were superior to the scores of good readers in the FEEDBACK group by 15 percentage points and were superior to the scores of good readers in the READ group by 16 points. There was little difference between groups on this measure of content comprehension for poor readers.

The expectation was that poor readers would benefit more from using the adjacent-to-text activities while reading than good readers. Researchers have suggested that high ability students do not need and may even be adversely affected by certain adjunct activities (Koran and Koran, 1975; Rothkopf, 1972a, Shavelson, et al., 1974). The findings of the present study are interpreted as an indication that the reverse situation may be the case. At least on the measure of content comprehension, good readers appeared to benefit more from the use of adjunct activities while reading than did poor readers.

These findings are similar to the findings of the Spiegel (1976) study that good but not average or poor readers show improved comprehension after training with adjunct questions. That receiving knowledge of results (written feedback) with adjunct activities did not improve the comprehension of good and poor readers again supports the notion that providing answers to adjunct questions may be unnecessary and may

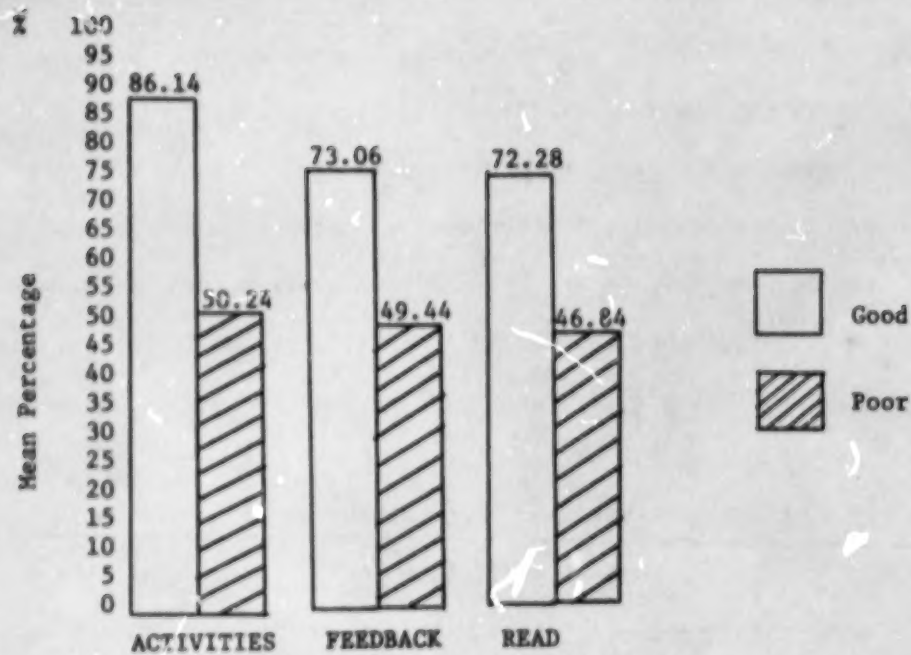


Figure 5. Good and poor readers' mean percentage scores on the total of four tests of text content comprehension.*

* 106 Items

even interfere with reading the relevant adjacent text portions.

Question 2

The possibility that adjacent-to-text activities would have a differential effect upon those with above or below average levels of knowledge of concepts related to the text content was examined. The following question was posed.

- (2) Was there evidence to suggest that those above or below average on a measure of prior knowledge of text-related concepts differ in comprehending text content when given text with adjacent-to-text activities?

The mean percentage scores on the total of four tests of text content comprehension for those in each group with above and below average prior knowledge are in Figure 6.

As compared to the READ group, those above the mean and below the mean on the measure of prior knowledge who received the ACTIVITIES treatment achieved an average of between 15 and 16 more correct answers on the total of the four tests of content comprehension. Students with below the mean scores on prior knowledge in the FEEDBACK condition were superior by 13 percentage points to the READ control. But there was little difference for those with above average prior knowledge between the FEEDBACK and READ groups.

The expectation was that students with a lower level of prior knowledge (those below the mean on the test of environmental concepts) would benefit more from the instructional support of a constructing response mode, or writing answers to adjacent-to-text activities than those with a higher level of prior knowledge (Tobias, 1976; Tobias

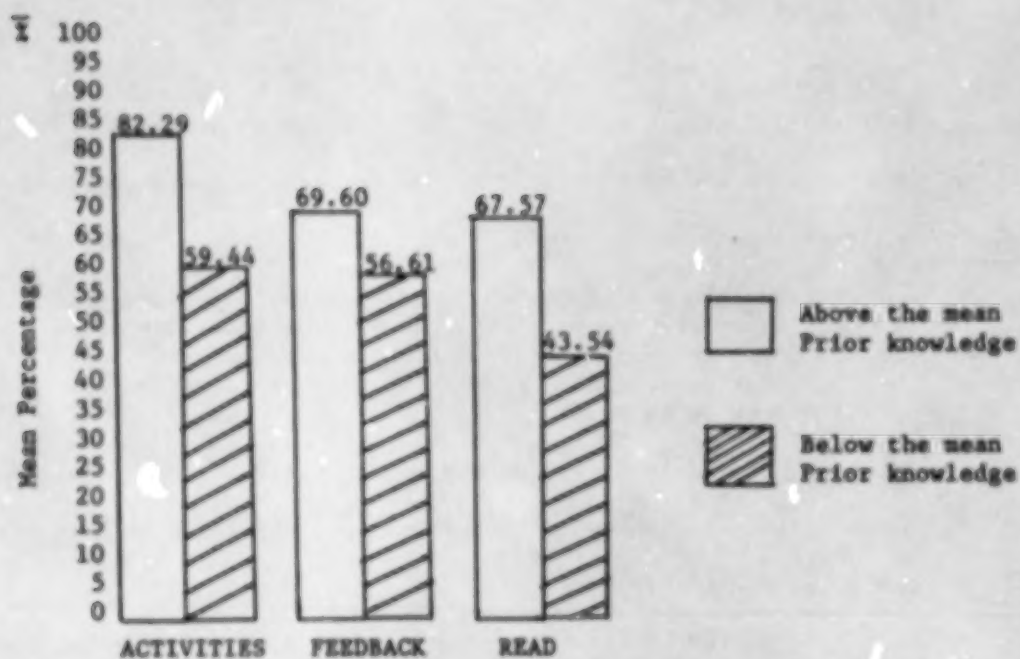


Figure 6. Students' level of prior knowledge and mean percentage scores on the total of four tests of text content comprehension.*

*106 Items

and Ingber, 1976). This was not the case. Those in both prior knowledge categories who used adjacent reading activities while reading comprehended the text content better than those who did not use activities. But as was the case for good readers, the comprehension scores for those with above average prior knowledge in the FEEDBACK condition were essentially the same as the scores of those above average in the READ control group.

Question 3

As explained earlier, comprehension of the text content was defined as both intentional and incidental. Intentional comprehension was measured by performance on test items designed to elicit the application of skills and recognition of text content used in responding to adjacent-to-text activities. To examine whether students using text with activities began to spontaneously apply skills to text without the direction of activities to incidental text content, the following question was posed:

- (3) Was there evidence to suggest that students who used skill development, adjacent-to-text activities while reading began to apply those skills to text without the assistance of adjacent-to-text activities? Or was there a decrease in the difference between intentional and incidental comprehension by the end of the training period?

As shown in Figure 7, there was not a decrease in the difference between intentional and incidental comprehension for the ACTIVITIES and FEEDBACK groups across the four tests of content comprehension. For the ACTIVITIES group, there was a decrease between intentional and incidental mean percentage of correct responses from the second

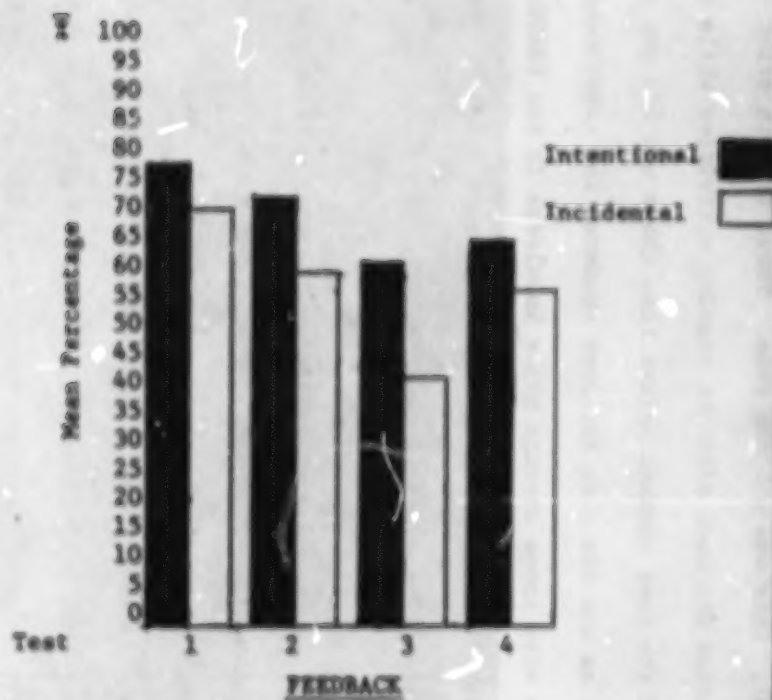
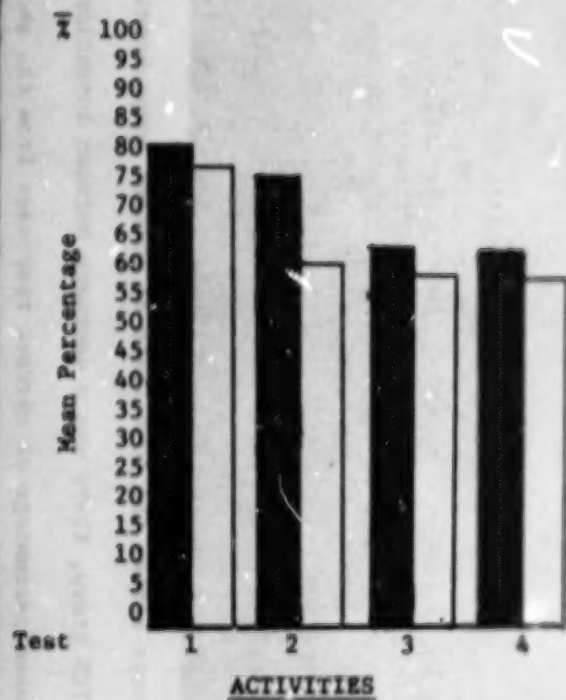


Figure 7. Treatment groups' mean percentage scores on intentional and incidental comprehension test items.

Where: Test 1 is "Life in Ecosystems"
 Test 2 is "The Kalahari"
 Test 3 is "Java"
 Test 4 is "New Orleans"

section "Kalahari," ($\bar{X}$ =14.76) to the third "Java", ($\bar{X}$ =5.55) but no decrease from the third section to the fourth section "New Orleans", ($\bar{X}$ =6.74). The prediction was that the intentional and incidental scores of students in the READ control group would not vary across the four tests of content comprehension. But as shown in Figure 8, this was not the case. Incidental comprehension was superior to intentional for the first two sections but inferior to intentional on the third and fourth sections. In other words there were sizeable differences between intentional and incidental comprehension scores for the READ group across the four tests.

That there was no evidence that readers who used adjacent-to-text activities began to spontaneously apply skills being developed to incidental text portions may be due to two possibilities. First, the students may not have learned the skills in question, which is suggested from the nonsignificant results of treatment effects on the measure of reading comprehension skill development. Second, they may have been able to answer the incidental test questions without having applied the particular skill to the incidental content and supposedly required in the test item. The incidental items were of content where a particular skill could have been applied but without assistance. A skill which was different from the skill required in an incidental item may have been applied to the incidental text via an activity. For example, an incidental item could be in the form of a paraphrase question of a sentence in text which had not had the paraphrase skill applied to it through an activity but instead, may have been used to develop or apply

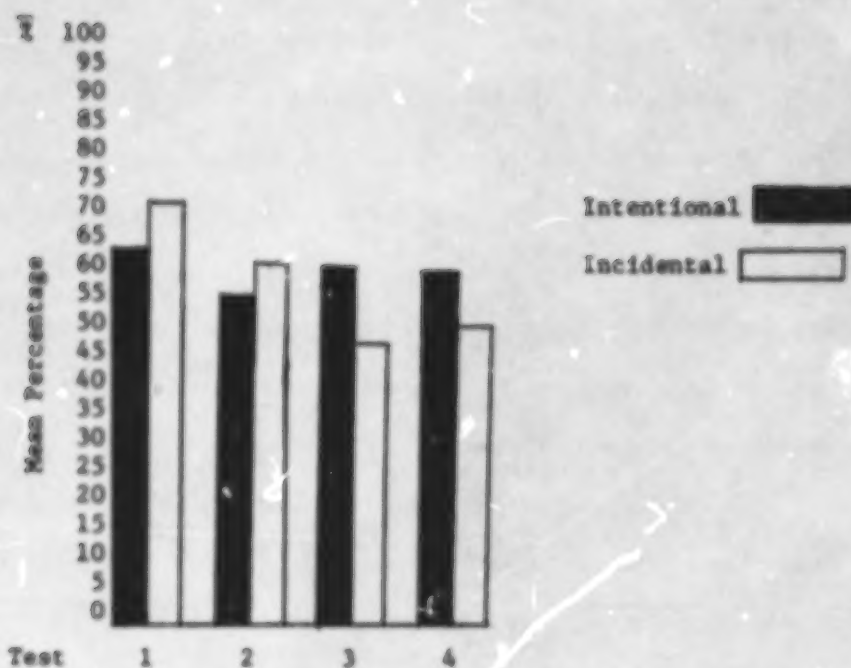


Figure 8. Control group's mean percentage scores on intentional and incidental comprehension test items.

Where: Test 1 is "Life in Ecosystems"
Test 2 is "The Kalahari"
Test 3 is "Java"
Test 4 is "New Orleans"

another skill. In other words, some of the incidental items involved text content which would have been processed during a skill development activity but not with the particular skill tested by a certain incidental item.

SUMMARY

As suggested by the nonsignificant results of an analysis of variance, 5th and 6th grade readers' comprehension skills did not improve after training with text containing adjacent-to-text activities. Comprehension of text content was significantly greater for those using the training materials as compared with a control group ($p < .0535$). Providing written feedback (the answer key) was not beneficial. The adjacent-to-text technique was neither enhancing nor debilitating for either poor or good readers, although poor readers demonstrated greater variability across the four comprehension skills. However, there was one exception. Good readers who used adjacent-to-text activities without feedback were superior to good readers in the other two groups on the measure of content comprehension. The text comprehension scores of readers with above and below the mean scores on a measure of prior knowledge who used adjacent-to-text activities were superior to those in the control group. But only those below the mean score on prior knowledge benefited from receiving written feedback, or knowledge of results. Finally, there was no evidence of the spontaneous application of skills to incidental text without the direction of adjacent-to-text activities. There was no clear trend to suggest that the difference between incidental and intentional content test scores decreased across

the four tests of content comprehension.

In the following chapter, these results will be reviewed. Also, the conclusions, limitations, and implications based upon the findings of the experiment to teach skills-in-text will be presented.

IV

SUMMARY, CONCLUSIONS, LIMITATIONS AND IMPLICATIONS

This chapter is primarily a review of the study conducted to improve readers' comprehension with a type of adjunct aid and suggestions for further research. After a summary of the experiment is presented, the conclusions which appear to be warranted from the results are stated. Rather than list the limitations and implications consecutively, they are discussed concurrently. This procedure was followed because the experimental design, procedures, and treatment limitations of the study seemed directly connected to ideas for changes to be made or new directions to follow in future research with the adjacent-to-text technique.

SUMMARY

The major purpose of this study was to determine whether a set of expository passages designed with adjacent-to-text activities (a type of adjunct aid) would facilitate the learning of reading comprehension skills concurrent with improving the comprehension of the text content. A second purpose was to determine whether written feedback would increase the effectiveness of adjacent-to-text activities. Other variables examined in testing the effectiveness of the technique were reading ability,

prior knowledge, and skill application without the assistance of adjacent-to-text activities.

Rationale

The rationale for the specific hypotheses and questions which were posed was based upon evidence to support 1) training readers in the use of reading comprehension skills, 2) the use of an adjunct aid format as a vehicle for training in comprehension skills, 3) the inclusion of selected variables, and 4) the usability and acceptance of the adjacent-to-text materials by students and teachers.

Some readers appear to lack adequate organizational strategies necessary for comprehending written prose materials (Levin, 1974; Okan, Wiener, and Cromer, 1971; Smith and Hesse, 1969). But failure to successfully employ an organizational strategy may be due to a lack of basic reading comprehension skills, e.g., the use of various context clues to determine the meaning of unfamiliar words, or identifying topic sentences. Comments on reading comprehension by Bormuth (1969), Laberge and Samuels (1974), and Spache and Spache (1973) support the assumption that conscious effort on the part of the learner and instruction may be needed for students to develop reading comprehension skills.

A problem with current attempts to teach reading comprehension skills is that the skills are often taught one at a time in isolation from the act of reading regular prose materials.

Various adjunct aids function to direct readers' attention to certain aspects of text and have improved readers' comprehension and retention of text information. A possible solution to the problem of teaching skills in isolation would be to teach skills in text as needed through the use of adjunct aids to direct readers' attention. Many attempts have been made to affect readers' comprehension strategies with adjunct aids, but few have attempted to use adjunct aids to provide training in strategies or skills to be used without prompting or the continual assistance of an aid or aids.

Two approaches have been used to manipulate readers' comprehension strategies. Direct approaches have been to provide the reader with instructions to form mental images, an advance organizer, instructions to use specific study techniques, and instructions to read for specific types of information. In general, none of these approaches has had much of an effect on readers' comprehension. Indirect approaches in which materials are altered have been used successfully to manipulate readers' comprehension strategies. Some techniques have been to provide varying word groupings, omit the final word in each sentence, add a word to every fifth word as a distractor, add outlines, summaries, or underlinings, add interspersed questions, and provide instructional objectives.

The adjacent-to-text activities designed to develop skills

while improving text comprehension are intended to function as pre-questions or instructional objectives; they should serve as orienters to activate and direct attention towards relevant text segments. Boker, 1974; Frase, 1967, 1968; Rothkopf and Bisbicos, 1967; and Swenson and Kulhavey, 1975, have reported that providing questions before or after text segments facilitate the retention of content which is relevant to the questions. In a similar manner, providing instructional objectives increases the retention of content which is relevant to the objectives (Duchastel and Brown, 1974; Kaplan, 1974; Kaplan and Rothkopf, 1974; Kaplan and Simmons, 1974; and Rothkopf and Billington, 1975). Although interspersed pre-questions and instructional objectives have a depressing effect on the amount of content learned which is not relevant to the questions (incidental learning), questions and objectives can be designed to require more thorough text processing. Because the adjacent-to-text activities are intended as a training technique rather than as a technique to induce a temporary study or reading behavior, the issue of intentional versus incidental learning is not relevant.

Attempts have been made to train readers with skills considered to be prerequisites to successfully employing a reading strategy. Children have been trained in the use of imagery skills prior to receiving instruction to use an imagery strategy while reading (Lesgold, et al, 1975; Pressley, 1976). Spiegel (1976) found that

good readers benefited from training in the use of interspersed post-questions when using materials containing questions as compared with good readers receiving training in the use of advance organizers and good readers in a comparison group. Average and poor readers did not benefit from training in the use of the two aids. There was no evidence that providing training in the skills assumed to be associated with the employment of each aid improved readers' comprehension of materials which did not contain the aids.

The use of an adjunct aid format in the present investigation was not intended as a technique to develop a particular reading strategy by providing practice in applying the skills associated with the employment of a particular adjunct aid. Instead, the intent was to capitalize upon the attention direction properties of adjunct aids. Comprehension skill development was expected to occur as a result of instruction in the use of skills and application through reading and writing responses to adjacent-to-text activities.

Another variable included in the study was feedback, or knowledge of results. The results of two major studies on the effect of providing answers to adjunct questions were positive (Fraser, 1967; Rothkopf, 1966). Providing feedback appears to have a direct instructive effect, or improves the learning of content relevant to the adjunct questions.

Research evidence supports the notion that the use of adjunct activities may have a different effect on students' with varying

reading abilities. Results of studies by Koran and Koran, 1975; Rothkopf, 1972b; and Shavelson et al., 1974, support the conclusion that the use of adjunct questions is more beneficial for students with low verbal abilities than for students with high verbal abilities.

Another variable which may interact with the use of adjunct activities is the student's level of prior knowledge of the subject matter. Results of research investigations support the conclusion that students with lower levels of prior knowledge benefit more from high levels of instructional support (constructing responses, i.e., writing answers and receiving feedback) than do students with higher levels of prior knowledge.

Further support for the present study to determine the effect of adjacent-to-text activities on readers' comprehension skill development and comprehension of text content is provided from the results of a preliminary study conducted by this investigator. The results of the preliminary study, despite no significant differences between the mean scores of students who used the adjacent-to-text activities and students in a control condition, were encouraging. The materials were usable and teachers and students were receptive of the adjacent-to-text technique.

Based on the preceding rationale, the following hypotheses and questions were formulated:

Hypotheses

- (1) Students who use adjacent-to-text activities while reading will attain significantly higher scores on a measure of overall reading comprehension skill development than students who do not use adjacent-to-text activities while reading.
- (2) Students who use materials with adjacent-to-text activities while reading will score significantly higher on a test of content comprehension than students who do not use adjacent-to-text activities while reading.
- (3) Students who receive written feedback on appropriateness of responses to adjacent-to-text activities will attain significantly higher scores on a measure of overall reading comprehension skill development than students who do not receive feedback on appropriateness of responses to adjacent-to-text activities.
- (4) Students who receive written feedback on appropriateness of responses to adjacent-to-text activities will score significantly higher on a test of content comprehension than students who do not receive written feedback on appropriateness of responses to adjacent-to-text activities.

Questions

- (1) Was there evidence to suggest that good and poor readers differ in learning skills and comprehending text content when given text with adjacent-to-text activities?
- (2) Was there evidence to suggest that those above or below average on a measure of prior knowledge of text-related concepts differ in comprehending text content when given text with adjacent-to-text activities?
- (3) Was there evidence to suggest that students who use skill development, adjacent-to-text activities while reading begin to apply those skills to text without the assistance of adjacent-to-text activities? Or was there a decrease in the difference between intentional and incidental comprehension by the end of the training period?

Method

In the present study, 54 students in a combination fifth-sixth grade classroom were selected as the sample population. The students had not been and were not receiving direct instruction to improve their reading comprehension skills. Good, average, and poor readers were randomly assigned to one of three groups.

The treatment materials included expository passages, adjacent-to-text activities, and answer keys to accompany the activities. The activities were designed to develop the Level E skills identified for the Wisconsin Design for Reading Skill Development: Comprehension (1977). Each activity was placed near to relevant text in a passage, indicated by a line marker in the text margin and a number corresponding to the number of the activity. Activities direct readers to read a short explanation of a specific skill, draw a picture to enhance or demonstrate understanding of a skill applied in text, or answer a question or questions.

The entire study was conducted over a period of 23 days. All students were administered a test of prior knowledge of text-related concepts before treatment sessions began. During the 14.5 hours spent in treatment sessions, one group (ACTIVITIES) used adjacent-to-text activities while reading the text, a second group (FEEDBACK) checked their responses to the adjacent-to-text activities with answer keys, and a third, or control group (READ) read the text but did not receive adjacent-to-text activities. Upon the completion of each of the four sections of the treatment materials the students were administered an experimenter designed multiple choice test of

test content comprehension. A test of skill development was administered during the final three days of the study. This test consisted of four selected tests of the Level E, Wisconsin Tests of Reading Skill Development: Comprehension (1977), forms P and Q. In an abbreviated form, the four skills tested were 1) identifying explicit context clues, 2) identifying central thoughts for passages with an organizer (topic sentence), 3) identifying conclusions for passages with a directly stated relationship, and 4) determining the sequence of events in passages with explicit sequential markers. The students were able to earn a total of four tangible rewards for working diligently each day.

Four planned orthogonal comparisons were performed on the test scores of the two dependent measures. All were tested at the $\alpha=.10$ level of significance. The analysis of variance procedure was used for the two comparisons performed on the measure of skill development. The analysis of covariance procedure was used for the two comparisons performed on the measure of content comprehension. All questions were answered with descriptive data resulting from converting sums of raw scores on all tests to percentages.

Results and Discussion

Results of analysis of variance of students' correct responses on a test of overall reading comprehension skill development indicated that there was no significant difference between the average mean score of the two treatment groups (ACTIVITIES and FEEDBACK)

and the mean score of the READ control group. (See Table 7.) Based on this result, the first hypothesis was rejected. This result is consistent with the finding in the preliminary study that the use of adjacent-to-text activities did not have an effect on fifth graders' reading comprehension skills.

From the analysis of covariance, there was a significant difference ($p < .0535$) between the average mean score of the two treatment groups and the control group on the measure of text content comprehension in the predicted direction favoring the treatment groups. (See Table 9.) On this basis, hypothesis 2 was accepted. This result differs from that of the preliminary study but is consistent with findings that interspersed questions and instructional objectives, both of which the adjacent-to-test activities resemble, have a direct instructive effect by improving intentional and perhaps incidental learning (Baker, 1973; Frase, 1967; Kaplan, 1974; Kaplan and Simmons, 1974; Rothkopf, 1966; Rothkopf and Bisbicos, 1967).

There were no significant differences in the mean scores of the ACTIVITIES and FEEDBACK groups on either the measure of skill development or on the measure of text content comprehension. (See Tables 11 and 12.) Hypotheses 3 and 4 were rejected. As suggested by Frase (1967), feedback may be redundant information which might even interfere with text processing behaviors.

A question examined was whether good readers or poor readers

differ in learning skills and comprehending text content when given text with adjacent-to-text activities. Mean percentages of correct responses on the measures of skill development indicated that the use of adjacent-to-text activities with or without feedback was no better or worse for good or for poor readers. (See Figures 2, 3, and 4.) There was little difference between groups for good or for poor readers. Poor readers did exhibit a slight difference in favor of the two groups using activities while reading but only on two of the four skills.

Mean percentages of correct responses on the total of the four tests of text content comprehension indicated that good readers who used activities without feedback (ACTIVITIES) did better than good readers in the FEEDBACK and READ groups. (See Figure 5.) There was little difference between good readers in the FEEDBACK and READ conditions on this measure. There was little difference between groups on this measure of content comprehension for poor readers. This result was the reverse of the expectation that high ability students may be adversely affected by certain adjunct activities (Koran and Koran, 1975; Rothkopf, 1972a, Shavelson, et al., 1974) but in agreement with the findings of the Spiegel (1976) study that good but not average or poor readers showed improved comprehension after training with adjunct questions. Again, the notion that feedback may interfere with reading relevant text was supported.

Group mean percentages of correct responses on the total of four tests of content comprehension were also compared for those above the mean or below the mean on a measure of prior knowledge of text-related concepts. (See Figure 6.) Students with either above or below average scores on the test of prior knowledge in the ACTIVITIES group did better than those with comparable prior knowledge in the READ group. This finding is contrary to the expectation that students with lower levels of prior knowledge would benefit more from the instructional support of a constructing response mode (adjacent-to-text activities) than students with higher levels of knowledge (Tobias, 1976; Tobias and Ingber, 1976). Students who were above the mean score on the measure of prior knowledge in the ACTIVITIES group achieved a higher proportion of correct responses as compared to those above the mean in the FEEDBACK and READ groups. Using written feedback may have an adverse affect not only on good readers as discussed above but on students with higher levels of prior knowledge. These students (FEEDBACK and above mean prior knowledge) did little better than those above the mean on prior knowledge in the READ control group. The students who were below the mean on prior knowledge in both activities groups (ACTIVITIES and FEEDBACK) answered more content comprehension questions correctly than those below the mean in the READ control group.

A final question was whether there was evidence to suggest that students in the two activities groups began to apply skills

to text without the direction and assistance of adjacent-to-text activities. An indication of a transfer effect would have been an increase in incidental content comprehension scores across the four tests with intentional comprehension scores (test items using content and skills relevant to adjacent-to-text activities) remaining constant. The control group was expected to exhibit a constant pattern across the four tests with little difference between incidental and intentional comprehension. These expectations did not occur. (See Figures 7 and 8.) For the ACTIVITIES group, incidental scores decreased rather than increased over the four tests. Similarly, the FEEDBACK group exhibited a decrease in incidental scores over the first three tests but unlike the other treatment group, incidental scores increased for the fourth test. The READ control exhibited a pattern across the tests similar to the FEEDBACK group except that incidental scores were superior to intentional scores on the first two tests but the opposite was the case for the last two tests. The absence of the expected trend suggests that 1) students did not learn the skills or if so, did not use them independently, 2) some of the incidental text content had been processed in response to activities and perhaps some incidental test questions could be answered without having applied the skill being tested, or 3) the incidental items may have been too easy on the first two tests but too hard on the last two tests, as suggested from the control group's pattern of performance.

CONCLUSIONS

The following conclusions are based upon the results presented above:

- (1) The use of the adjacent-to-text activities designed for this study while reading does not have a facilitative effect on the development of reading comprehension skills on fifth and sixth graders.
- (2) The use of the adjacent-to-text activities designed for this study while reading does improve the text content comprehension of fifth and sixth graders. The adjacent-to-text activities appear to function like other adjunct aids, in particular like interspersed questions, in improving the learning of text content relevant to the adjunct aids.
- (3) In general, providing written feedback to be used with the adjacent-to-text activities designed for this study does not improve the effectiveness of the use of adjacent-to-text activities to develop skills or improve content comprehension. There is some evidence that feedback may have a negative effect on the performances of those who are good readers and/or possess high levels of prior knowledge of the subject matter. For poor readers and those with low levels of prior knowledge, providing feedback, or answers to

adjacent-to-text activities made little difference as measured by performances on tests of the dependent variables.

- (4) The adjacent-to-text activities are not more beneficial for good readers or for poor readers in terms of skill development or text content comprehension. The exception was the effect of feedback mentioned above.
- (5) The adjacent-to-text activities are not more beneficial for those who are above average in prior knowledge or for those who are below average in prior knowledge.
- (6) Students using skill development, adjacent-to-text activities did not transfer the use of the particular skills to neighboring text without the assistance of adjacent-to-text activities.

LIMITATIONS AND IMPLICATIONS

Although results suggest that students' comprehension of text can be improved with the use of activities designed to teach skills in text, it is not recommended that content area materials be designed or redesigned with adjacent-to-text activities. The intent was to train students in the use of skills while reading. It was thought that with training, students would eventually consciously or unconsciously apply skills as needed without the assistance of

activities. Because there was no evidence that readers' comprehension skills were improved, it is not suggested at this time that the adjacent-to-text technique be adopted as a training procedure for skill development.

Future research with an adjunct aid format as a vehicle for skill development seems warranted as the adjacent-to-text activities appeared to function to direct readers' attention to relevant text inducing more active and thorough text processing. This is indicated by the comparison of scores on a measure of text comprehension for those who used the activities while reading with a control group. Alterations in the experimental design and procedures as well as changes in the treatment materials should be considered in future experimentation on developing skills in text.

Design and Procedures

The following design and procedural limitations of the present study presented implications for further research. Each statement of a limitation is followed with a discussion of the implication or implications for future research.

(1) Because the subject sample was not randomly selected from the larger population of fifth-sixth grade classrooms meeting the selection criteria, the results of this study are not generalizable beyond the sample population. The study should be replicated with a sample which has been randomly selected from the universe of fifth-sixth graders meeting the selection criteria of this study.

If this is not possible, the study should at least be replicated with a sample similar to those of the present study.

(2) Although the sample population was not receiving direct instruction to improve their reading comprehension skills, many of the readers in the sample may have learned the skills of concern to the present study without direct instruction. In further studies, only those students who are identified as lacking adequate reading comprehension skills should be selected as subjects. One possibility in identifying those who could profit most from skill instruction would be to administer one form of the Level E Wisconsin Design Tests of Reading Comprehension Skill Development: Comprehension (1977) as a pretest and then select subjects on the basis of a predetermined criterion of non-mastery of the skills. An alternative would be to select poor comprehenders in a manner similar to the Wiener and Cromer (1967) classification of the "difference" poor reader. Wiener and Cromer used students' scores on subtests of a standardized reading achievement test. Difference poor readers have average or good vocabulary scores but poor comprehension scores. Both of these schemes are susceptible to error because test scores used for individual decisions are often unreliable. A third possibility would be to devise another system to identify poor comprehenders who are able to read individual words. Information from several sources could be evaluated, such as 1) an informal decoding or word recognition task, e.g., a word list, 2) a

comprehension task, e.g., silent reading of a paragraph and unprompted recall, 3) ratings by observers of ability to verbalize techniques used to get meaning from words, sentences, and passages, and 4) teacher judgement. Such a classification system would be time consuming to construct and administer but if successful could be replaced with a highly correlated but simpler measure.

(3) The text content which the students were given was judged to be rather difficult for the fifth-sixth graders. The overall rating from the application of the Dale-Chall readability formula was on the seventh to eighth grade level. While the treatments did appear to assist readers in comprehending the text content, they did not improve readers' comprehension skills. Perhaps the assumption that reading comprehension skills are best developed with difficult materials is invalid or at least may not apply to the learning of these particular skills. In future experiments to determine the effect of skill instruction through the use of adjunct aids, the difficulty experienced in reading the text should be reconsidered. Holding reading ability constant, one could establish students' levels of familiarity with the content by administering a cloze passage to test students' abilities to fill in every deleted fifth or tenth word. A study could be designed to determine whether materials which are fairly easy to read are more appropriate for skill instruction than more difficult materials.

(4) The results of the present study may have been affected

by the high motivation instilled by the system of tangible rewards and may not generalize to the results of the use of the comprehension materials without rewards. Adjunct aids are considered to be most helpful in low incentive situations such as where the text content is considered to be dull. Yet, an assumption in this study was that unless the students were highly motivated, they might not be actively applying the skills which they possess or are to be learning while reading. But the reward system did not appear to compensate for the lack of receiving the adjacent-to-text treatment for the control group. Their scores on the measure of text comprehension were significantly lower than those of the two treatment groups. To avoid a possible confounding effect from using a system of rewards with the materials but yet maintain student interest, scheduling intermittent breaks throughout the administering of treatment sessions should be considered.

(5) Another limitation in the present study is the measure of comprehension skill development. The Design tests may not measure the use of skills as trained with the adjacent-to-text technique. The tests assess each skill separately after the reading of brief passages rather than test the application of a combination of skills in text while reading as needed. A procedure more appropriate for eliciting the performance of the behaviors to have been trained would be to design a transfer passage of comparable content and difficulty structured to require the

application of the Design skills without the assistance of activities. The students could be prompted to apply the skills they have learned previously. An objectively scored test or a form of aided or unaided recall could be used to measure the application of skills. An alternative would be to design a test passage with adjacent text questions in a format similar to the adjacent-to-text activities. Each test question would require application of one of the specific Design skills to the adjacent text included within a line marker.

(6) The effect of the use of the treatment materials may not be the same with different directions in their use. Although students were told to read until they came to a line marker in the right margin and then to read the adjacent activity, it was observed that some students simply read each activity and then searched the adjacent text within the line marker for information but ignored unmarked text portions. In future experiments students could be directed to read the entire passage first and then go back and do the adjacent activities. On the other hand, directions could be given to do the activities first and then go back and reread the entire passage.

(7) Time spent in processing the text content was not controlled. The control group did not spend as much time as the treatment groups did in looking at or reading the passages. In the future, the time factor could be controlled by using a comparison

treatment which requires subjects in the comparison group to spend as much time actively involved with the text content as the treatment groups.

Treatment Materials

The following discussion is of treatment limitations and implications for further research.

(8) The treatment may not have been long enough. There may not have been enough materials with adjacent-to-text activities to have an effect on the skill development of those using the activities. A possibility to be considered in the future is whether to increase the length of the treatment materials with additional passages and adjacent-to-text activities.

(9) Another limitation is that the results of the present study apply only to the particular adjacent-to-text activities designed for the present study. A different set of adjacent-to-text activities might be more effective for use in training readers' comprehension skills. In the adjacent-to-text activities of this study, there may not have been enough written definitions of the skills and explanations of why and how to use them to gain meaning from text. In other words, there may have been too many skill application activities and too little instruction in using the skills within the adjunct activities. Another approach would be to systematically introduce skills more gradually, beginning with skills dealing with smaller units of text. For example, word

meaning skills could be introduced first, then sentence meaning skills, and finally the passage meaning skills could be developed. The materials of the present study which combines the use of all skills in text as needed could be administered after the provision of training with each skill separately.

(10) Finally, there is the possibility that the students learned or knew the reading skills but failed to use them on the incidental text content and the skill development tests. This phenomenon is referred to as a "production deficiency" by Flavell, 1977, p. 198. The reason for failing to use the skills could be because the students were not provided with training in metacomprehension skills to enable them to determine where the application of skills could be of value. Metacomprehension skills are the skills one uses to monitor one's understanding of spoken and written messages. Brown (1977) puts it this way:

The problem of ascertaining the state of one's own ignorance or enlightenment is one of metacomprehension. Understanding instructions would be a case of comprehension of a message, while knowing that one has understood, or not would be an example of metacomprehension (p. 9).

A careful examination of the literature on metacomprehension could provide insights for expanding the treatment of this study to include an awareness of why and when to apply specific skills as well as the awareness of why and how strategies in general may

be useful to improve one's reading comprehension. It would seem that a system of periodic summaries that review what has been taught and preview what is to be presented next could be incorporated within the materials. Also training sessions could be administered prior to treatment where poor comprehenders are first made aware of how a more general strategy such as self-questioning could be used to help them pause, reflect, reread, and discover what is impeding their comprehension of a passage. A training technique of this type could precede the introduction of the specific Design skills. Students could be periodically asked to explain where and how a skill could be used to improve their understanding. Or the materials could be redesigned with interspersed questions. The questions could be followed by examples of how applying a skill or skills will help them with the meaning if they are unable to answer a question correctly. One drawback here is that showing the reader how to use a skill or skills to construct meaning from text does not show the reader why he or she erred in the first place.

The obvious limitation to expanding the materials to include a gradual introduction and then combination of skills as well as training in awareness of why the specific skill or strategies in general may be beneficial is the amount of written instruction students are capable of processing. This is a major problem if subjects are poor comprehenders. Perhaps the emphasis will change from emphasizing individualized self-directed and self-paced

materials for introducing and teaching skills to teacher directed activities for skill introduction and the materials for skill application.

In concluding, the adjacent-to-text format appears to be a viable technique for inducing readers to actively possess text passages. Fifth and sixth graders who read passages with the assistance of the adjunct activities did comprehend more of the text than did those who did not use the activities while reading. But unless the adjacent-to-text technique can be shown to have an effect on readers' comprehension skill development, there would appear to be little reason to continue this line of research. As stated earlier, the use of altered materials incorporating the aids was to provide training in skills to be used eventually without altered materials. However, the concept of developing skills in text should not be abandoned because the adjacent-to-text activities appear to direct readers' attention to specific text portions and to affect the processing of text. In the future, the adjacent-to-text technique should be conceptualized within, or as a part of a broader training program of comprehension skill introduction, application, and practice.

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